Author:
Driver, Louise C G

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The relationship between mind wandering and subjective well-being

a cross sectional study of depression, anxiety, stress, sleep quality, positive affect and motivation.

The relationship between mind wandering and subjective well-being: a cross sectional study of depression, anxiety, stress, sleep quality, positive affect and motivation.

Louise Driver

University of Bristol

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Abstract

Frequent mind wandering has previously been found to predict poorer well-being (e.g. Killingsworth & Gilbert, 2010). Many previous studies of mind wandering are based on experience sampling, asking questions about current focus and well-being. However, this study employed a cross-sectional survey design. Phase 2 of the Bristol Well-Being Group (BWBG) questionnaire was completed electronically by members of the general population (*n* = 638). Questions probed general well-being and mind wandering over the past 6 weeks. Factor analysis revealed three types of mind wandering: negative, neutral and positive and a fourth factor indicating preference for external engagement. The survey also examined well-being and revealed a 29-factor structure. Six of these well-being factors were examined for their relationship with different kinds of mind wandering: depression, anxiety, stress, sleep quality, positive affect and motivation. Results indicated that frequent neutral and negative mind wandering predicted poorer well-being on virtually all of these well-being dimensions. Positive mind wandering was found to increase positive affect and motivation and reduce low mood but did not significantly predict anxiety, sleep quality or stress. Mediation analyses demonstrated that the influence of negative and neutral mind wandering on mood was associated with complex patterns of mediation. For example, although negative mind wandering predicted stress, this effect was fully mediated by depression, anxiety and sleep quality. This study displays that cross-sectional measures of mind wandering predict levels of well-being with large effect sizes and emphasises the importance of understanding the negative effects of mind wandering in order to generate further theory and efficiently establish interventions which prevent poor well-being and potential onset of mental health conditions.

Dedication and Acknowledgments

I would like to thank my supervisor Professor Kit Pleydell-Pearce who supported me throughout the degree process and who, in sharing his advanced knowledge and academic ability, helped me to become confident in my own ability. I also thoroughly enjoyed being able to explore my own ideas through being part of an innovative research project which examines human well-being on a massive scale. I would finally like to dedicate this degree to my family and partner as without their continuous support this would not have been possible.

Author's Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's *Regulations and Code of Practice for Research Degree Programmes* and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

SIGNED: …….Louise Driver…… DATE:……..27/10/2020…….

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Chapter 1 Introduction

1.1 Introduction to Internal cognition

Each of us are familiar with the fact that elements of our experience seem to be directed outward towards the external world. Such outward directed forms of experience can sometimes be associated with goal-directed activity (e.g. playing tennis) and sometimes associated with an absence of goal-directed activity (e.g. watching television). However, at other times, our experience can detach from the present moment and move inwards and be associated with thoughts about the past or future, or about particular preoccupations, some positive, some negative and some neutral. In some cases, internally focused processing may be task and goal-related, such as when attempting mental arithmetic to derive a mean of several numbers in order to support an externally focused goal of reporting a mean. However, in other cases, internally focused activity may detach from the external present such as when thinking about the past or the future. When internally directed cognition detaches from the immediate present, terms such as "mind wandering" are applied to this process (e.g. Smallwood and Schooler, 2006; Christoff, Irving, Fox, Spreng and Andrews-Hanna, 2016). Moreover, the balance between internal versus external focus can shift rapidly even during goal-directed activity. Such rapid transitions have been demonstrated under laboratory-controlled conditions (e.g. Vanhaudenhuyse et al., 2011). Research has indicated that the frequency of internally directed mind wandering is high. Klinger (1999) and Killingsworth and Gilbert (2010) have shown that the average human mind can wander as much as 50% of the day, throughout daily life our minds drift inward to internal representations of the past, present and future, during a wide range of activities (Randall, Oswald and Beier, 2014). Even during the relatively short length of time it takes to read this chapter your mind will most likely wander.

The term mind wandering is one of many terms used to describe the act of bringing focus inwards away from external stimuli. However, a multitude of varying names for this phenomenon are present in the literature. Examples include: internal cognition, stimulus independent thought, daydreaming, fantasy proneness, task-unrelated thought, spontaneous cognition to name only a few (Williamson, 2006; Antrobus, 1968; Singer, 1975; Klinger, Henning & Janssen, 2009; Giambra, 1989; Christoff, Irving, Fox, Spreng & Andrews-

Hanna, 2016). This diversity of nomenclature poses a difficulty within the field as authors must undergo unnecessary laboured efforts in order to find and report previous literature on the topic, or risk missing key related articles in their research. However, one publication (Callard, Smallwood, Golchert and Margulies, 2013) examined the evolution of terms used to refer to internal cognition. Their findings indicated that the term 'mind wandering' rose in popularity in 2010 and is now the most frequent label used in current research to explain internally directed thoughts which reflect detachment from the present moment.

Singer (1955) was a pioneer in discussions about the wandering mind. His research into daydreaming paved the way for considerable future research on the topic. Early research on daydreaming led to the construction of the imaginal process inventory (IPI; Singer and Antrobus, 1966), followed by the short imaginal process inventory (SIPI; Huba et al., 1981). These innovative and extensive questionnaires examined a wide range of factors relating to daydreaming such as content, frequency, how easily one is distracted and visual imagery. Statistical analyses of the two surveys resulted in the identification of three key forms of daydreaming. First *positive constructive daydreaming* shown through planning and creativity. Second *guilty-dysphoric daydreaming* described as obsessive and linked to sadness. Third *poor attentional control* which can be described as the inability to concentrate on both external tasks and internal streams of thought, this is obtrusive and maladaptive to external tasks (Singer, 1975). These three key forms of mind-wandering laid the foundations for future researchers and are still reflected today in current research (Merlo et al., 2019). First, via research examining mind wandering as beneficial, specifically for creative incubation and problem solving (Baird, Smallwood, Mrazek, Kam, Franklin & Schooler, 2012). Second, mind wandering's relationship to mental health as seen through rumination (Marchetti et al., 2014). Third, through the connection between mind-wandering and poor attentional control (Smallwood and Schooler, 2006) for example suggesting that higher levels of mind wandering impair driving performance (Yanko & Spalek, 2014). The early and historic interest in mind wandering has now expanded into a very large research focus. Research questions have probed content and frequency of mind wandering (Killingsworth and Gilbert, 2010), its relationship to poor mental health (Smallwood et al., 2009) and potential benefits (Smallwood & Andrews-Hanna, 2013). With the advancement of brain imaging technology, considerable current research concentrates on the

neuropsychological processes involved in mind wandering, specifically the presence of a system known as the default mode network (DMN; Raichle et al., 2001; Kucyi & Davis, 2014). The DMN is associated with a pattern of increased brain activation within medial frontal and medial posterior cortical regions which frequently occurs during imaging of the resting brain (see ahead).

1.2 Internal cognition in neuropsychology

Previous sections have indicated how an independent interest in internal cognition and mind wandering (e.g. Singer, 1955) pre-dated the development of modern brain imaging techniques such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI). However, findings associated with resting state scans revealed frequent activation of brain networks described as the DMN which correlated with task irrelevant cognition and mind wandering. It is probably fair to suggest that this finding was accidental and occurred because "resting state" scans were employed as baseline controls for comparison with task-related scans. This discovery is not surprising given estimates that mind wandering has been found to occupy as much as 50% of human waking cognitive activity during experience sampling studies such as Killingsworth and Gilbert (2010) where mind wandering was reported in 46.9% of samples in 2250 participants, or Kane et al. (2007) where mind wandering was reported occurring during 33% of daily life for 126 participants. Moreover, studies of autobiographical memory recall or prospective thinking also revealed activations which included components of the default mode network (e.g. Spreng et al., 2009). Also, many studies noted that activity within the default mode network was anticorrelated with goal-related tasks requiring externally oriented attention (e.g. Gusnard and Raichle, 2001; Buckner et al., 2008).

As imaging techniques evolved, researchers were able to further explore key brain regions involved during resting states and eventually establish which systems make up the default mode network DMN (Raichle et al., 2001). In one perspective, (Raichle, 2015) the DMN is proposed to be separated into three subsections: dorsal medial prefrontal cortex (DMPC), ventral medial prefrontal cortex (VMPFC), and posterior cingulate cortex, along with the precuneus and the lateral parietal cortex. However, an emphasis upon VMPFC is not common to all positions with others preferring to focus upon DMPC and posterior medial structures (e.g. Mulders et al., 2015; Menon, 2011). In some perspectives, the

posterior default mode network also includes elements of inferior parietal lobe, lateral temporal cortex and hippocampal formation (Mulders et al., 2015). Interestingly, however, some have argued that mind wandering involves similar brain regions to dreaming (e.g. Domhoff, 2011; Domhoff and Fox, 2015) and Solms (2000) reported that lesions to ventral medial prefrontal cortex (ventro-mesial quadrant) abolish or attenuate self-reported dreaming. A relevant finding is reported by Herbet et al., (2014) which demonstrated that electrical stimulation of human precuneus, a key component of the posterior default mode network, disconnected conscious experience from the external world. During periods of stimulation, there were reports of mental time travel to different places and times such as to a beach, with experiences described as being “dream like”. The medial prefrontal cortex is also associated with future thinking and episodic memory recall, the ability to collect and manipulate this information is apparent when creating a mental landscape during spontaneous thought (Schacter at al., 2012).

One modern perspective suggests a relationship between three key brain networks, DMN, central executive network (CEN) and a salience network (Mulders et al., 2015; Menon, 2011). For Mulders et al. (2015) the central executive network is seen as encompassing DLPFC, posterior parietal cortex, components of dorsomedial PFC and frontal eye fields. In the Menon (2011) perspective, the DLPFC and posterior parietal cortex are the key elements of the CEN. The salience network is associated with brain regions which respond to the importance of perceived events (internal or external). In both models this system includes the insular cortex and anterior cingulate with both models noting close anatomical connections between these regions and amygdala, nucleus accumbens, ventral tegmental area and anterior cingulate gyrus. A central argument is that the salience network reflects a system that is constantly assessing events, and that salient events can shift the balance between internalised cognition (DMN) and central executive network. For example, a sudden loud noise could alert the salience system diverting internally directed thought to externally oriented behaviour via activation of CEN. However, it is important to note that salient events can be both positive as well as negative. It is argued that the salience network plays a key role in activating CEN and reducing activity in DMN. This proposal is supported by evidence that increased activity in the salience network is correlated with increased activity within CEN (Menon, 2011). Both theoretical approaches argue that the balance

between goal-oriented CEN activity and DMN activity is compromised by defective salience processing and this deficiency lies at the centre of many psychiatric disorders (e.g. depression and anxiety). These considerations indicate one mechanism whereby heightened DMN activity might be correlated with poorer well-being and reduced CEN activity, and this hypothesis is considered in more detail in the following sections of this introduction. In relation to this, Lant et al. (2016) argued that certain severe disorders of consciousness display defects in the ability to switch from internal cognition to external cognition. They argued that the key element of the switch involved regions of the precuneus, and when non-functional, patients were "trapped" in a state that did not correspond with either resting state DMN or outwardly focused brain activity.

In another study (Vanhaudenhuyse et al., 2011) participants were asked to keep their eyes closed for 15 minutes and at various points were probed by a tone at which point they had to report levels of internal and external focused cognition on a four-point scale. External orientation was defined in terms of awareness of the environment (sounds, smells somatosensory experiences) and internal orientation was defined as wandering thoughts, (such as autobiographical memories or inner speech). Behavioural data indicated that simultaneous reports of internal and external cognition were anticorrelated. Event-related fMRI indicated that internal cognition was associated with increased activity within medial frontal regions and posterior cingulate, precuneus and parahippocampal cortex. In contrast, periods of external cognition were associated with increased activation within DLPFC and bilateral inferior parietal lobe. The authors concluded that their findings indicated the existence of distinct "extrinsic" and "intrinsic" neural systems, the former corresponding with a goal-directed lateral fronto-parietal regions, and the latter system corresponding with mind wandering and daydreaming. These findings are consistent with distinctions between CEN and DMN discussed above (Menon, 2011; Mulders et al., 2015).

Some authors have argued that mind wandering includes a vast range of processes, such as recalling past events, theory of mind and future planning, and that this cognitive complexity and diversity is too complex for the DMN to handle alone. Fox et al. (2015) reported a meta-analysis which explored brain regions activated across 24 studies of mind wandering. They reported that, during mind wandering, brain regions outside of the DMN were activated as frequently as the regions within it, most noticeably, within the

frontoparietal control network. The frontoparietal control network is associated with goal directed planning and is anatomically associated with the DMN, as well as the dorsal attention network which is engaged during external focus. Findings from Spreng et al. (2010) suggest that the frontoparietal control network mediates the relationship between the DMN and the dorsal attention network depending on whether the content of the goal-directed cognition is internally or externally focused. For example, the DMN and frontoparietal control network were engaged during autobiographical planning (such as imagining the future) and the dorsal attention network and the frontoparietal control network were engaged during visuospatial planning (such as The Tower of London task; Shallice, 1982). Therefore, it is possible that some regions outside of the DMN work flexibly alongside the DMN, in order to complete a wide range of processes associated with mind-wandering.

An interesting implication of these findings is that some forms of internal cognition are goal driven, such as when trying to imagine the future or trying to remember past events (e.g. Conway and Pleydell-Pearce, 2000). In other cases, however, internal cognition might be more passive, and less goal directed. This suggests that connectivity between frontal control networks and the DMN may vary with more extreme absence of frontal engagement associated with greater detachment from the external world. In contrast, more goal directed forms of internal cognition (e.g. what did I do on my 21st birthday?) may require integration between frontal control systems and elements of internalised cognition.

1.3 Internal cognition and general well-being

A considerable amount of research into mind wandering focuses on its similarities with ruminative symptoms in relation to a wide range of mental health disorders (Smallwood et al., 2009). However, analyses of non-clinical populations have also indicated that mind wandering results in reduced mood, regardless of whether the topic of the mind wandering was negative or neutral (Killingsworth and Gilbert, 2010). In their study, Killingsworth and Gilbert (2010) constructed an online app-based survey which probed the internal cognition and levels of well-being in a sample of 2,250 individuals. Participants were randomly alerted by the app throughout the day to report their well-being, their current activity and mind wandering. The well-being question asked, “how are you feeling right now?” which was answered very bad to very good on a sliding scale of 0-100. Participants

were also given an activity question, asking what activity they were engaged in (there were 22 activities to choose from, they picked as many as was relevant). Examples of these activities include working, doing housework, travelling, talking with others and preparing food. Participants were also sometimes asked a mind wandering question "Are you currently thinking about something other than what you are doing?". The mind wandering question had four answers to choose from: no, yes-something pleasant, yes-something neutral or yes-something unpleasant. In contrast to the well-being and activity questions which were presented in every sample, the mind wandering question was randomly presented in a subset of samples. Prior to beginning the study participants were asked how frequently they wanted prompts from the app, they could choose once, twice or a maximum of three times per day. Participants were also instructed to report when they typically woke up and went to sleep. From this information, prompts for samples were organised to be randomly presented over the length of the day and new randomised times were generated each day. Participants continued to receive daily prompts from the app until they chose to discontinue their participation in the study. However, once 50 samples had been taken from the same participant sampling ceased for 6 months, unless the participant chose to restart the sampling process earlier. Results of the survey confirmed that people's minds wandered in 46.9% of all reports and wandered at least 30% of the time in all activities except "making love". They showed that the precise activity being performed had very little influence on whether the mind wandering topic was pleasant, neutral or unpleasant. Most importantly, however, their findings revealed that participants were less happy when mind wandering compared to not mind wandering. Findings indicated that both negative and neutral mind wandering were associated with significantly lower well-being versus not mind wandering. Furthermore, people engaged in pleasant mind wandering were no happier than when not mind wandering. The most frequent kind of mind wandering was categorised as pleasant (42.5%) followed by neutral (31%) and then negative mind wandering (26.5%). A key aspect of this study was the indication that mind wandering involved three distinct types of internal cognition: positive, neutral and negative with each form associated with a significant proportion of waking life. Interestingly, this study indicated that mind wandering accounted for a greater proportion of variance in well-being than the actual activity people were engaged in and that these two sources of variance were largely independent. It was noted that negative mind wandering might be

preceded by the experience of negative events. However, time-lag analyses were argued to rule out this possible confound.

Poerio, Totterdell & Miles (2013) questioned Killingsworth and Gilbert's (2010) conclusion that suggested that prior negative external events did not lead to negative mind wandering. They argued that the original study had insufficient sampling frequency to rule out this hypothesis. They used a higher experience sampling rate (6-7 samples daily per participant compared to Killingsworth and Gilbert, 2010 who took 1-3 samples daily per participant) and also measured levels of sadness and anxiety and probed the nature of mind wandering content in more detail. Their findings indicated that earlier experiences of sadness led to higher rates of subsequent mind wandering. In addition to this, contents of mind wandering had a greater amount of sadness or anxiety when following prior episodes of sadness or anxiety. They also reported that mind wandering was only associated with concurrent lower mood if mind wandering content was negative. Finally, they reported that instances of mind wandering had no significant effect upon future levels of well-being. While this study had a higher experience sampling rate, it examined 24 participants whereas Killingsworth & Gilbert's sample size was 2250. However, the findings do clearly display that a more developed experience sampling rate is important when making more detailed conclusions about relationships between mind wandering and mood.

Wilson et al., (2014) noted that most previous literature exploring relationships between mind wandering and well-being are performed in relation to an external task. That is, the main focus was upon distraction from an ongoing task. Therefore, their study examined a tendency to mind wander in the absence of an external task. They hypothesised that in the absence of any external demands, with only internal cognition available, participants would struggle to maintain pleasant mind wandering topics. The authors conducted ten studies which analysed this hypothesis. Studies 1-6 asked participants to sit alone in a plain, empty room without any personal possessions or external activities for 6 - 15 minutes depending on the condition. 89% of participants reported that their mind had wandered, 57.5% that it was hard to concentrate and 49.3% reported that they did not enjoy their experience of having nothing to do. Study 7 was the same except participants completed the experiment at home and were asked to remove any distractions prior to beginning. Similar findings to studies 1-6 were reported, with the additional discovery that

32% of participants reporting that they had "cheated" and engaged in an external activity. Overall, the findings supported the idea that a lack of opportunity to engage in an external task reduced well-being, although this study did not include a control group. Thus, study 8 included an additional external activities group who were able to distract themselves, e.g. use their phone for games or reading. Participants in the external activities group reported greater enjoyment, less mind wandering and increased concentration than the control group. These findings were replicated in the ninth study which recruited participants from the general population rather than university students. Results confirmed that their findings were not connected to age, education, income or use of social media or increased use of mobile phones.

Most interestingly, Study 10 introduced the option to self-administer an electric shock during a period of sitting alone with nothing to do for 15 minutes. This study was performed in a group of participants who had previously experienced an electric shock and who had indicated that they would pay $5 not to receive the shock again. Interestingly, 67% of men and 25% of women self-administered an electric shock during the 15-minute period. This suggested that sitting alone was so aversive that participants sought to engage in a task that had previously been rated as sufficiently negative to merit payment to not experience it again.

Although research connecting mind wandering to poor well-being dominates the literature, it is important to note that some have argued that mind wandering can also benefit well-being. Franklin et al. (2013) replicated Killingsworth and Gilbert's (2010) study again showing mind wandering is most frequently associated with negative well-being. However, the authors added an additional measure not employed by Killingsworth and Gilbert (2010) of "how interesting" the mind wandering was. Results demonstrated that positive mind wandering which was experienced as interesting increased positive mood.

This section has introduced studies concerned with general relationships between mind wandering and well-being. In subsequent sections, mind wandering is considered in connection with particular instances of poor well-being with examinations of depression, anxiety, stress, sleep quality and low motivation.

1.4 Internal cognition and depression

Mind wandering is often explored in relation to its effects upon general low mood (Smallwood et al., 2009). However, mind wandering is frequently examined in connection with heightened sadness and depression, in particular, due to its congruity with rumination. Rumination can be described as the act of internally and obsessively concentrating on symptoms of distress, as well as upon the reasons for and consequences of this distress (Nolen-Hoeksema, 2000). Rumination is an associated symptom of depression in the Diagnostic and statistical manual of mental disorders 5th edition (DSM-V; American Psychiatric Association, 2013). Further, it has strong links to a majority of the eight key symptoms of depression. This includes feelings of worthlessness/excessive guilt, diminished ability to concentrate and recurrent thoughts of death. Mind wandering is, therefore, frequently related to rumination due to its internally focused nature and has been associated with the onset of rumination and depressive symptoms (McLaughlin & Nolen-Hoeksema, 2011). Hoffman, Banzhaf, Kanske, Bermpohl and Singer (2016) analysed mind wandering in participants with Major Depressive Disorder (MDD) using an experience sampling study. They found that MDD participants were more likely to mind wander than the non-clinical control group. MDD participant thoughts were predominantly negative and were mostly related to past events and of a self-orientated nature. The frequency of positive thoughts was also reduced versus the control condition. Interestingly, the researchers reported that the strongest predictor of negative self-generated thoughts was the absence of positive thoughts, and they suggested that this may be a useful diagnostic feature of depression versus other conditions (e.g. anxiety and other mood disorders). Overall, the frequent association between mind wandering and depression suggests that an important therapeutic intervention might be to encourage externally focused cognition. Such manipulations are described later in this introduction.

The link between mind wandering and depression and rumination have also been demonstrated in neuropsychology research, specifically into neural circuits, such as the DMN, which exhibits abnormal activity levels in those with depression. Fischer et al. (2016) reviewed previous research examining dysfunctional connectivity between the DMN, the affective salience network and the cognitive control network in patients with MDD. The authors argued that the dysfunctional connectivity in the three neural circuits had been found to initiate many symptoms of depression. The DMN, as mentioned previously, is

associated with resting state and self-referential cognition and mind wandering. The salience network regulates motivation and behaviour and the cognitive control network fuels goal orientated and externally focused attention. The authors summarised from previous literature that hyperconnectivity within the DMN is associated with increased rumination about the self and that levels of hyperconnectivity are correlated with the length and severity of depressive symptoms. The review also concluded that the DMN was critically found to interact with the affective salience network and the cognitive control network to create and intensify depressive symptoms. In particular, the subgenual rostral anterior cingulate (sgACC) component of the salience circuit was argued to be hyperconnected with the DMN leading to diminished behavioural reactivity in conjunction with increased negative affect. Interestingly, the sgACC is considered to be a major component in unipolar depression (Drevets et al. 2008) and exhibits reduced activity levels in depressed versus non-depressed participants. According to Fischer et al. (2016) hyperconnectivity between the DMN's internal processes combined with the motivational and behavioural processes in the affective salience network, equated to reductions in reward systems and increased severity and duration of depressive symptoms. Dysfunction in the DMN and the cognitive control network contribute towards reductions in concentration and magnifies focus upon internal processes rather than external stimuli.

Further support for the role of the DMN in depression can be found in studies which manipulate the DMN to some extent and result in the reduction of depressive symptoms. Selective serotonin reuptake inhibitors have been found to reduce hyperactivity in the DMN and may therefore function in reducing ruminative symptoms (Posner et al., 2013). Also, Franklin et al. (2015) established that cognitive behavioural therapy (CBT), a well-known psychological therapy which relieves symptoms of mental health disorders, was associated with reduced activity in brain regions associated with the DMN and concurrently reduced depressive symptoms.

Overall, this section indicates that depression is associated with increased levels of internal focus, elevations in DMN activity, an excess of negative thoughts and rumination, a lack of positive internal thoughts and deficient activation of brain regions associated with external orienting. These observations go a long way towards explaining why a dominant feature of depression is the absence of motivation (e.g. Smith, 2013) which typically require

external focus. Relationships between mind wandering and motivation are explored in a later section.

1.5 Internal cognition and Anxiety

The DSM-V (American Psychiatric Association, 2013) defines generalised anxiety disorder as the occurrence of frequent excessive worrying which is difficult to control. Symptoms include increased restlessness, fatigue, irritability, muscle tension and decreased concentration and sleep quality. Individuals with higher levels of anxiety have increased activity within the salience system (Pannekoek., et al 2013) and poorer coupling between ventromedial prefrontal cortex and amygdala (Urry et al., 2006) which is thought to reflect an inability to downregulate anxiety. Worry, in its definition, is an exaggerated form of mind wandering characterised by repetitive self-generated thought which moves focus away from external sensory information, and to internal cognitive activity. Mind wandering, or worry, engaged in anxiety is recognised to be predominantly future-orientated and in response to anticipated threats (e.g. Klinger, 1996). Correspondingly, research indicates that people with higher levels of trait neuroticism exhibit higher levels of mind wandering, especially during cognitive tasks and they tend to report poorer levels of attentional control (e.g. Robinson et al. 2017). In a related study, Forster et al. (2015) demonstrated that participants high on trait anxiety exhibited poorer performance in a Go-No Go task, higher levels of mind wandering during task performance and reduced levels of DLPFC activation during task performance. Interestingly, connectivity between DLPFC and posterior default mode systems (precuneus, posterior cingulate) was greater for those with higher levels of trait anxiety. This suggests that some elements of frontal control may be diverted towards internalised cognition in individuals with anxiety.

Whilst depression and anxiety share similarities in excessive internally focused thoughts, routes to anxiety may manifest earlier on in the stages of information processing than depression (Gotlib & Joormann, 2010). For example, subliminally presented threat-stimuli can invoke subsequent worrying spontaneous thoughts (Williams et al., 1988). Mathews (1990) noted that during the process of worrying, individuals rehearse potential/ imaginary negative events while simultaneously exploring strategies to avoid them. For someone with anxiety this might be construed as beneficial, because when the anticipated threat becomes a reality, they have prepared coping mechanisms. However, when this kind

of anticipatory activity becomes excessive it becomes destabilising. Clearly, anxiety is a normal emotion (Quirk, 2007) but it becomes dysfunctional when expressed in unnecessary contexts. However, the more frequently the worrying process is perceived to be successful, the more likely one is to use this process again in the future. Thus, dysfunctional anxious thoughts are developed and perpetuated.

Anxious thoughts negatively impact well-being directly as well as influencing other maladaptive well-being factors such as depression, stress and poor sleep quality (e.g. Hamilton et al. 2007). Previous research has established that the reduction of anxious internal thoughts is sufficient enough to reduce overall symptoms of anxiety and to improve well-being. One such method is by an increase in self-compassion. Self-compassion has close links to mindfulness, a well-known and much researched therapy used in reducing internal focus and initiating increased external focus (Raes, 2010). In this study, the mediating effects of rumination and worry between self-compassion and anxiety and depression were explored. Two hundred seventy-one psychology students were asked to complete a collection of questionnaires related to self-compassion, depression, anxiety, rumination and worry. Mediation analyses were performed with brooding and worrying as mediators. Findings revealed that increased levels of self-compassion were associated with reduced worry and rumination and reduced anxiety. This compliments previous research which evidences how the reduction of frequent negative thoughts (such as worry or rumination) is beneficial for well-being.

Worry has also been found to negatively impact on the quality of sleep, which then exacerbates the influences of worry upon well-being. Coles et al. (2015) examined previous research which explored effects of anxious mind wandering upon sleep and well-being. The review noted that anxiety-related psychological traits associated with frequent internalisation collaborate to reduce sleep quality and influence poor well-being. The psychological traits analysed were anxiety sensitivity, perfectionism and neuroticism. Anxiety sensitivity related to a predisposition to have worrying thoughts about physical sensations such as sweating and fast heartbeat. Perfectionism included internal thoughts related to poor self-esteem, self-doubt and fear of making mistakes. Finally, the study demonstrated that neuroticism was frequently associated with excessive thoughts and feelings of fear, guilt, envy and anxiety. This research review not only illustrates how anxious

thoughts directly influence poor well-being, but also how anxious internal thoughts mediate negative effects of other well-being variables (such as anxious thoughts negatively impacting sleep quality) to collaboratively reduce well-being.

1.6 Internal cognition and sleep quality

Poor sleep quality has often been associated with poor well-being (e.g. Johnson et al., 2006). The occurrence of poor sleep quality can be initiated by a range of factors, many of which include the presence of some form of spontaneous mind wandering. We have all experienced the feeling while trying to fall asleep, that no matter how hard you try, your mind seems unable to stop assessing what happened that day, or worrying about the next day or the future, or even concerns about the difficulty of falling asleep. This spontaneous internal mentation, which has been found to be most prevalent in those with poor well-being, is a process which is associated with the prevention of good sleep quality from occurring (Takano, Iijima and Tanno, 2012). However, there is some evidence that while low mood and rumination both predict poorer sleep quality, a tendency to ruminate can predict sleep quality even when controlling for low mood (Thomsen et al., 2017).

Emotional responses to stress, such as rumination and worry, have been discovered to negatively impact sleep quality. Lund et al. (2010) conducted an online study probing sleep habits. The survey employed a range of sleep quality measures including the Pittsburgh Sleep Quality Index (PSQI). 1,125 university students completed the survey, ages ranging from 17 to 24 years old. The students that reported poor sleep quality also reported higher levels of negative moods such as negative affect, anger, tension and depression. Stress and tension accounted for 24% of the variance in PSQI scoring and most recorded written answers about trouble sleeping were related to stress and worry, such as “racing thoughts” or “worry about the future”. In partial support of these findings, a laboratory study reported by Gross and Borkovec (1982) recruited 38 female participants to assess stress induced sleep latency. The participants in the experimental condition were told to go to sleep as quickly as possible and informed that at the end of the session they would be contacted to present a speech (the speech topic was also given to the participant). Those in the experimental condition reported greater stress prior to sleeping as well as reduced sleep time, more disturbed sleep and increased time to fall asleep compared to controls. These

findings highlight the negative impacts of rumination and worry caused by stressful life events upon sleep quality.

Disrupted sleep can also generate mind wandering. Carciofo et al. (2014) found that physical sleep disruptions, such as needing the bathroom or feeling too hot, positively correlated with increased mind wandering when attempting to fall back to sleep. This suggests that once the individual was awake and devoid of external distractions, they were more likely to focus internally and found it difficult to reduce mind wandering and go back to sleep. Mikulincer et al. (1989) also discovered a negative correlation between levels of mind wandering and hours of sleep. Participants were involved in a sleep deprivation experiment which lasted 72 hours. During the study they were engaged in a range of visual and logical tasks. Participants were also frequently asked to report their mind wanderings. The results demonstrated that increased hours without sleep were associated with more frequent mind wandering episodes during external tasks which impaired task performance. This illustrates how mind wandering can be initiated by poor sleep quality, as well as preceding it. Interestingly, there is evidence which indicates that sleep deprivation reduces activity within frontal and parietal regions associated with cognitive control (e.g. Ma et al., 2015). As these control systems are anticorrelated with DMN (e.g. Menon, 2011) this provides a potential explanation for increased mind wandering following sleep deprivation.

Poor sleep quality has frequently been associated with increased depressive and anxious symptoms. Gobin et al. (2015) examined sleep quality in relation to sustained attention, emotional memory, stress and affective symptoms. Their findings showed that reports of poor sleep quality increased negative cognitive bias towards negative stimuli. That is, those who experience poor sleep quality are more likely to be attracted to negative stimuli in daily life, and therefore perpetuate their low mood. Symptoms of insomnia affect around three quarters of patients with depression (Yates et al., 2007) and insomnia is a known risk factor for suicide (Agargun et al., 1997). Nutt et al. (2008) explored the extent to which poor sleep quality effects depression. The authors employed an online survey probing sleep quality and depressive symptoms to members of the Depression Alliance charity. The participants responded to questions asking whether they experienced difficulty sleeping when they felt depressed and whether this affected their quality of life. Most of the participants felt that their sleeping difficulties began concurrently to the onset of

depression. Findings also revealed that 97% of participants reported experiencing poor sleep quality and 59% reported that difficulty sleeping directly affected their quality of life.

This section has provided evidence that mind wandering negatively impacts sleep quality through rumination and worry which is often brought on by stress and pre-existing low mood. This cycle can be perpetuated by the reactive characteristics of rumination, worry and poor sleep quality upon each other. A number of papers provide discussion of the complex relationships between sleep and well-being and all state that poor sleep is caused by a number of factors which are likely to be cyclical in causality (for example, poor sleep increases anxiety, and, anxiety causes poor sleep; see Pace-Schott et al., 2015; Cox & Olatunji, 2016, Kahn et al., 2013).

1.7 Internal cognition and stress

Seventy four percent of adults in a 4,169 participant survey in the United Kingdom reported feeling so stressed in the past year that they felt they were too overwhelmed and were struggling to cope. Thirty two percent of adults in the same sample reported suicidal thoughts due to stress and sixteen percent of adults reported that they had self-harmed as a result of stress (Mental Health Foundation UK, 2018).

Transactional models of stress argue that the occurrence of a stressful life event initiates coping mechanisms which can be either task-focused or emotion-focused (Folkman & Lazarus, 1984). Task-focused strategy involves maintaining an external focus, successful task performance and preventing distractions. Emotion-focused coping strategy, however, facilitates an internal focus upon personal worries and disrupts task performance. A pre-existing negative mood can also influence the coping strategy initiated after a stressful experience occurs. Vinski and Watter (2013) examined coping mechanisms in those with elevated low mood. Participants completed the Positive and Negative Affect Schedule to analyse mood and then were randomly assigned to a stress condition (high or low). Following this, all participants completed the sustained attention to response task (SART) to examine mind wandering. Participants who reported worse low mood and who were randomly assigned to a high stress condition, reported activating an emotion-focused coping strategy with increased reports of mind wandering and poorer task performance.

This supports the idea that stress is a key influencer upon frequency of mind wandering and can influence as well as be influenced by low mood.

Mind wandering as a coping strategy for stressful life events has a negative impact upon well-being as it prevents a solution focused strategy which can relieve negative symptoms of internal cognition and increases susceptibility to more long-term mental health conditions such as depression or anxiety. Mazure (1998) analysed findings relating to stress induced depression and found that 80% of individuals with depression reported a stressful life event occurring prior to the onset of depressive symptoms. Further, McGonagle and Kessler (1990) reported that chronic stress (defined as high stress levels present for over a year) was a more powerful predictor of the onset of depression than onset of acute stressors. This suggests that increased exposure to stressful stimuli, as well as the use of an emotion-coping strategy (internal cognition), contributes to the likelihood of developing depressive symptoms.

1.8 Internal Cognition and Motivation

Motivation can be defined as an internal state which initiates, maintains and directs a person's behaviour to a chosen goal. Motivation increases one's focus on achieving a personal goal and away from internal distractions, thereby reducing frequency of spontaneous mind wandering (e.g. Seli et al., 2015). Mind wandering has been found to negatively influence one's ability to conjure motivation to achieve one's goals, most frequently in individuals with depression. Ruminative thoughts prevalent in depression have been reported to include thoughts about how unhappy and unmotivated the person feels, coupled with an inability to improve their feelings. Frequent rumination has similarly been found to negatively affect motivation in problem solving (Lyubomirsky & Nolen-Hoeksema, 1995). In the Lyubomirsky & Nolen-Hoeksema (1995) study a clinical sample of patients with depression were given an initial task which was either ruminative or distracting. Following the task, they were asked to respond to imaginary problems, which were either personal or achievement related. Participants were asked to write down the steps they would take to solve the problems. Those who had engaged in the initial ruminative task were less able to create successful solutions to the problems compared to those who did the distracting task. This impaired task performance was proposed to portray a deficit in motivation. This research indicates the negative effects of mind wandering upon motivation. It also indicates

the benefits of external focus upon motivation and well-being because those who engaged in the distraction task, and were more externally engaged, and were more successful in completing the problem.

There are intriguing links between motivation and well-being. A substantial body of evidence indicates that drugs which stimulate mesolimbic dopamine or deep brain stimulation (DBS) to dopamine regions leads to improvements in positive affect. Results of DBS (for comprehensive review see Lakhan and Callaway, 2010) suggest that stimulation of dopamine-associated regions such as ventral tegmental area or nucleus accumbens can produce states of intense positive affect. According to Berridge and Kringelbach (2011, 2015) these intense experiences of positive affect are not associated with hedonic pleasure, but instead, intense increases in motivation in which previously depressed individuals experience a sudden and intense motivation to engage in externally related activities. These experiences are argued to reflect a dopaminergic role in "wanting" behaviours, where the desire to attain outcomes translates towards externally oriented goal-seeking. These considerations provide further insights into the relationship between motivation and well-being, but also indicate that treatments which focus on re-orientation to the external world might be particularly effective. This prediction is addressed in the next section.

1.9 Altering mood via orienting cognitive focus externally

Nix et al. (1995), examined the effects of external focus upon individuals with depression. Depressed and non-depressed participants were randomly assigned to complete either an external or internal focused task. The evidence showed that engagement with an external task significantly reduced depressed mood in those with mild depression. Interestingly however no significant improvement in mood was found for those without depressive symptoms who engaged in the external task. This suggests that increased external focus may be particularly helpful in improving well-being in those who have low mood and/or who are living with a mental health condition.

In addition to deliberately orienting participants to external events, it is possible to examine effects of ongoing self-focus. Green et al. (2003), recruited 79 undergraduate students to participate in a study which examined the ability of happy mood to reduce self-focused attention. Participants were randomly assigned to an experimental condition

(happy, sad or neutral). Participants first listened to a piece of music which was aimed to induce the mood relative to their experimental condition; the music chosen for each condition was previously validated to represent the corresponding mood in prior research (Wood et al., 1990). Then participants completed a task which measured levels of self-focused attention, this consisted of the individual listing every thought that came into their mind for 2.5 minutes. Next, participant mood was measured in three ways. First, participants were asked to rate their mood on a visual analogue scale. Second, by counting from 1-10 out loud at their own pace, this has previously been found to distinguish between happy and sad moods through the participants pace of counting (Clark & Teasdale, 1985). Third, participants responded to questions on a 9-point Likert scale (1- not at all, 9- very, very much) which measured their keenness to participate in eight pleasant activities such as going to a party. Results revealed that those who were assigned to the sad experimental condition were more likely to have increased self-focused attention than those in the neutral and happy conditions. Whereas those in the happy condition were more likely to have reduced self-focused attention. Their findings supported the theory that happy mood brings focus away from internal thoughts and towards external stimuli.

1.10 Introduction to the current study

When assessing relationships between mind wandering and well-being there are two broad options. First, studies can utilise experience sampling (e.g. Killingsworth and Gilbert, 2010). The advantage of this approach is good temporal resolution. A second approach is to consider mind wandering to be a characteristic which individuals have a disposition to, this can then be compared with other well-being variables such as levels of anxiety, depression, positive affect, stress, sleep quality and motivation. This thesis adopts the second approach and attempts to examine levels of mind wandering in the population using an online questionnaire. We employed questions probing levels of negative, positive and neutral mind wandering and also asked participants whether they preferred “living in the real world” rather than “in their own thoughts.” The questionnaire also probed a wide range of dimensions of well-being.

Our questions probing well-being were based on data derived from Phase 1 of the Bristol Well-Being Group (BWBG) questionnaire. Phase 1 of the study began with a review of 105 published scales of well-being. These included questionnaires assessing happiness,

satisfaction with life, anxiety, depression and many other measures. The 105 questionnaires are presented in Appendix A and Appendix B describes each of the 105 questionnaires and provides information about the number of scale items, the number of subscales, whether the scale measures state or trait well-being and also the number of domains of well-being the scale is purported to measure. It is disconcerting that the number of domains each scale claims to measures frequently extends beyond the number of subscales derived from factor analysis. Analysis of these scales revealed 45 distinct components of well-being and these are presented in Appendix A. Members of the BWBG created a large questionnaire which attempted to ask questions addressing all 45 well-being components. The final questionnaire selection was also subjected to scrutiny by 10 chartered Clinical Psychologists who were paid to assess (1) adequacy of question wording, (2) the extent to which the overall questionnaire assessed all 45 well-being constructs. The psychologists were current and previous students on the diploma in Clinical Neuropsychology at the University of Bristol and were recruited by email, upwards of 130 qualified clinical psychologists (practitioner psychologists registered with the health and Care Professions Council) were were contacted and 10 were selected from those who responded.

The completed well-being questionnaire was administered to 871 people (mean age 26.2 years, range 18-84 years). Factor analysis of this data revealed a 21-factor solution, and these are depicted visually in the correlation matrix shown below (Figure 1) and detailed in Appendix C. In this figure, all scales were adjusted so that a higher score always referred to higher levels of well-being (this is the only time this form of scale inversion will be employed in this thesis). Inspection indicates that virtually all well-being factors were intercorrelated. This high level of intercorrelation is consistent with recent theoretical suggestions that brain mechanisms connected to well-being are highly distributed and non-modular and transcend simple distinctions between positive and negative affect and do not support the existence of basic primary emotions (e.g. Lindquist et al., 2012, Pessoa and McMenamin, 2017).

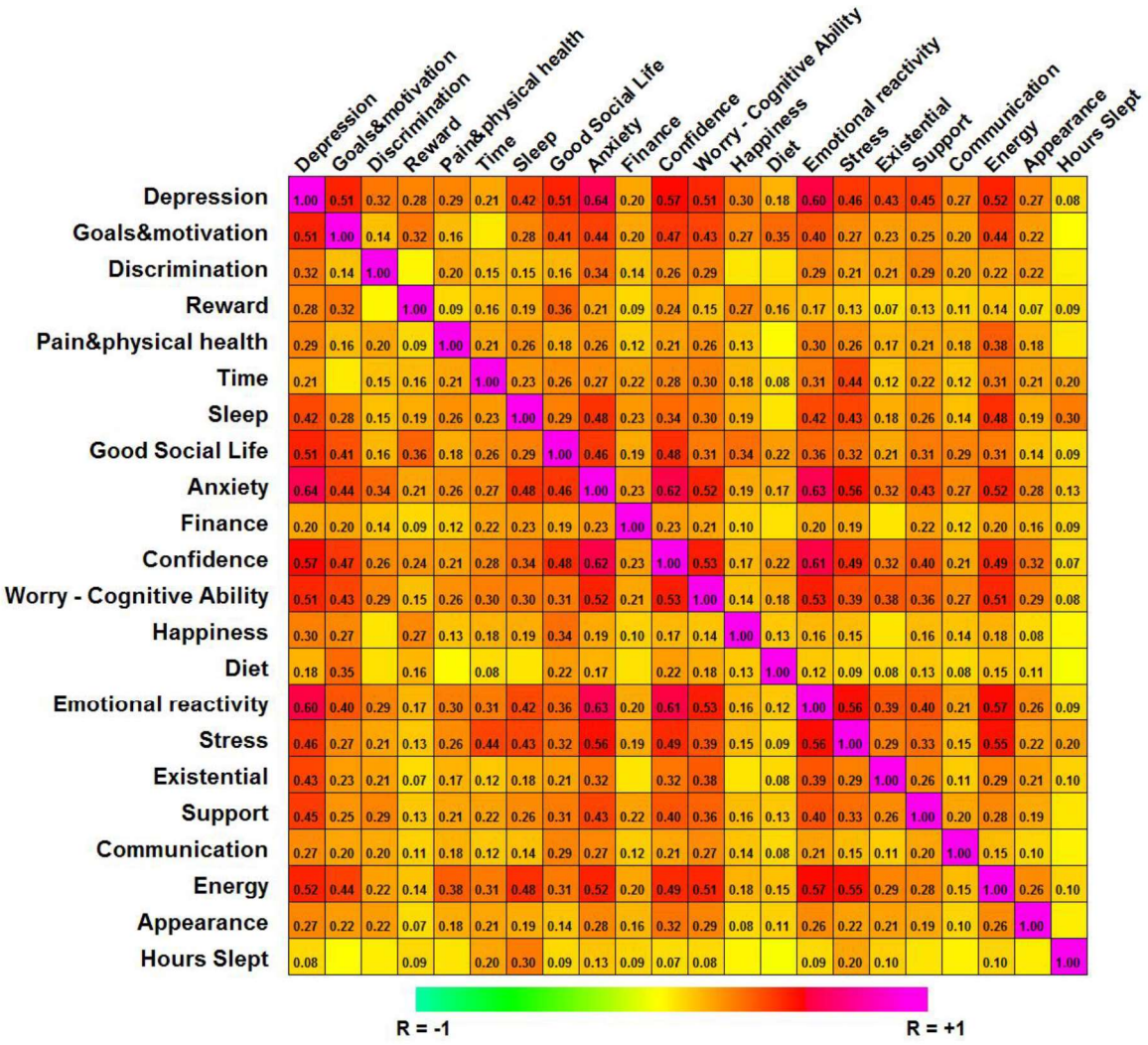

Figure 1 21 dimensions of well-being derived from factor analysis applied to well-being survey (*n*=871). In this figure, all scale directions were adjusted so that a higher score indicates higher well-being. Inspection reveals that virtually all 21 factors were correlated with each other. When a correlation is not reported, the relationship was not significant.

The phase 1 questionnaire was a large study, but in many ways was a pilot study which aimed to establish whether a large multifactor model of well-being could be established. While the survey attempted to assess 45 distinct domains of well-being, factor analysis revealed a 21-factor solution. This thesis makes use of data from a phase 2 version of this questionnaire in which various improvements were made. These included improved question wording, rejection of redundant items and addition of further questions where deemed relevant. The phase 1 questionnaire did not include many questions probing internal cognition and these were added to the phase 2 questionnaire**.**

Chapter 2 Hypotheses

Following previous research, we hypothesise that mind wandering is an internal phenomenon which has high frequency in the majority of the general population. We expect to find that many elements of mind wandering will exhibit a negative correlation with components of well-being (especially levels of depression, anxiety, stress, sleep quality, positive affect and motivation). Finally, we expect to demonstrate that a preference for external focus increases well-being. Our detailed hypotheses are listed below.

2.1 Hypothesis 1

We predict that our questions that probe mind wandering will establish separate factors corresponding with negative mind wandering, positive mind wandering, and a factor associated with a preference for internally versus externally focused cognition. Given prevalence rates of neutral mind wandering (Killingsworth and Gilbert, 2010) a factor corresponding with neutral mind wandering might also emerge, though we were insufficiently confident of this to make a definitive prediction. Nevertheless, we did employ questions that probed neutral internal mind wandering and predicted (following Killingsworth and Gilbert, 2010) that these individual questions will predict poorer well-being. A very important prediction here relates to combined effects of different forms of mind wandering. When predicting relations between mind wandering and well-being, we predict that negative mind wandering, positive mind wandering, neutral mind wandering and a propensity for external versus internal cognition will independently predict poorer well-being. This prediction entails that our predictors are not eliminated within multiple regression models. We note that findings from Killingsworth and Gilbert (2010) predict that positive mind wandering leads to no better well-being than externally oriented cognition, but these were the highest states of well-being in their sample. Thus, we predict that a propensity for positive mind wandering predicts better well-being.

2.2 Hypotheses 2 Examining the nature of mind wandering

Following Killingsworth and Gilbert (2010), we predict that:

2.2.1 Most people are frequently lost in their own thoughts

2.2.2 Frequent mind wandering can be both positive and negative

2.2.3 Following Hoffman et al., (2016) we hypothesis that fewer internal positive thoughts increase likelihood of frequent negative thoughts

2.2.4 The more one mind wanders the less one is externally focused

2.3 Hypotheses 3 How mind wandering effects well-being

2.3.1 Frequent negative and neutral internalisation is associated with poor well-being

Results are expected to demonstrate that high scores on the questions probing frequency of non-positive mind wandering will be associated with increased reports of low mood/mild depression, anxiety, poor sleep quality and stress, as well as decreased scores in positive affect and motivation (Killingsworth & Gilbert, 2010). It should be noted that all of these elements of well-being were identified in factor analysis associated with the phase 1 well-being survey and we predict that these factors will replicate in the phase 2 survey.

2.3.2 Negative mind wandering will predict poor well-being

Higher levels of negative mind wandering will be associated with increased depression and anxiety, poorer sleep quality, higher stress, and decreased scores on positive affect and motivation (Hoffman et al., 2016)

2.3.3 More frequent positive thoughts will predict higher positive well-being

We expect to find that increased scores on the positive mind wandering questions will accompany higher scores on positive affect and motivation. In addition, it is predicted that positive mind wandering will be associated with lower depression, anxiety, stress and improved sleep quality (Andrews-Hanna et al., 2013)

2.3.4 A preference for external focus will predict better well-being

High scores on the question “I have preferred living in the real world rather than in my own thoughts” will predict increased scores in positive affect and motivation, and healthier scores in depression, anxiety, poor sleep quality and stress (Nix et al., 1995).

2.4 Hypothesis 4 Mediating factors of well-being

The introductory chapter provided evidence that mind wandering is associated with reduced well-being on various dimensions (e.g. depression, anxiety, stress, and sleep

quality). This thesis offers opportunities to see how different kinds of mind wandering predict distinct well-being categories (e.g. anxiety or depression). It also allows an examination of how well-being factors, grouped as a set of regressors, predict different kinds of mind wandering. However, another factor of potential interest is whether the relationship between mind wandering and well-being might also be associated with mediations among well-being variables. For example, is the relationship between negative mind wandering and depression mediated by sleep quality or by stress? This kind of questions enables researchers to move from simple statements such as X predicts Y, and permits an understanding of *possible* causal relations between X and Y. In the introduction, it was noted that sleep deprivation is associated with increased levels of mind wandering (Mikulincer et al., 1989) and it is known that depression is associated with poorer sleep quality and sleep duration (Nutt et al., 2008). In this example, it can be asked whether the relationship between mind wandering and depression might be mediated by sleep quality. In this sense, mediation analyses provide opportunities to explore potential "pathways of influence" (Darlington and Hayes, 2016). Mediation analysis enables an estimation of direct effects (relationship between mind wandering and depression) and also potential indirect effects, where relationships between mind wandering and sleep quality, and sleep quality and depression suggest a mediating relationship. In some cases, complete mediation can be demonstrated in which the relationship between X and Y is fully mediated by Z with the direct effect between X and Y rendered non-significant. More frequently and when significant mediation is present, a more typical finding is a combination of significant direct and indirect effects. The demonstration of mediation does not provide clear grounds for asserting causality, but it does permit interpretations which can motivate future research. In this vein, the current study examines whether the relationship between negative mind wandering and each well-being factor might be mediated by other well-being factors. In order to keep these analyses controllable, we focused upon measures of negative well-being (depression, anxiety, stress and poor sleep quality) and ignored positive well-being (positive affect and motivation). These analyses were planned for both negative mind wandering and neutral mind wandering. Positive mind wandering or a general preference for "living in the real world" were not included in mediation analysis. It can be argued that if a variable is employed within mediation it must itself be modifiable. In terms of current planned

analyses, depression, anxiety, sleep quality and stress are all modifiable traits and this modifiability is the basis of clinical research.

2.5 Hypothesis 5 Internal cognition and Mental Health Conditions

Frequent internal thoughts occupy a majority of individuals in the general population, regardless of the presence of a mental health condition.

As found in previous research (Killingsworth & Gilbert, 2010) mind wandering occurs frequently throughout the general population, as well as those who are clinically diagnosed with a mental health condition (McLaughlin & Nolen-Hoeksema, 2011). Therefore, we will conduct moderation analyses in order to ensure that the negative effects of mind wandering are not wholly caused by the presence of a mental health condition in a proportion of our sample.

Chapter 3 Methods

3.1 Participants:

In total 1045 participants completed the core Well-being survey, and 638 participants completed the well-being survey with additional questions associated with types of mind wandering and internal and external focus questions. Participants were recruited through a range of means. First, University of Bristol students received Research Pool credit points upon completion of the survey. Second, in response to an email advertisement, emails were sent to various charity email lists such as Bristol MIND. Third, in response to advert placed on the School of Experimental Psychology's website. Fourth, in response to a hand-out leaflet advertisement, leaflets were given out in and around Bristol including on University of Bristol campus and at a university organised neuropsychology event. Finally, through word of mouth and social media websites (websites included Facebook, Instagram and Mums Net).

Participants' (n=638) age ranged from 17 to 84 and were predominantly in their 20's (M=29.9), were predominantly female (524 females, 110 males, 4 reported 'other'), and

ranged in ethnicity (Table 1), educational level (Table 2) and reports of their primary role (Table 3). 31.18% of participants reported living with a mental health condition.

All participants, except those who had already received Research Pool credit points, had the opportunity to be enrolled in a cash prize draw which included five chances of winning £100.

The study was granted ethical approval by the University of Bristol Ethics Committee (approval Code: 19625).

Table 1

Ethnic group and Background Percentages

Ethnicity	**Percentage %**
Arab	0.8
Asian/Asian British: Bangladeshi	0.3
Asian/Asian British: Chinese	2.5
Asian/Asian British: Indian	0.6
Asian/Asian British: Pakistani	0.4
Asian/Asian British: Other	1.1
Black/Black British: African	1.1
Black/Black British: Caribbean	0.4
Black/Black British: Other	0.1
Mixed/Multiple ethnic group White and Asian	1.7
Mixed/Multiple ethnic group: White and Black African	0
Mixed/Multiple ethnic group: White and Black Caribbean	0.6
Mixed/Multiple Ethnic group: Other	1.5
White: English/Welsh/Scottish/Northern Irish/British	75
White: Gypsy or Irish Traveller	0
White: Irish	1.72
White: Other	11.28
Other	0.47

Table 2

Educational Level Percentages

Educational Level	**Percentage %**
No educational qualifications	1
AS/A-levels	5.3

GCSE or 'o' levels	42.6
BTEC, NVQ or equilivent	5.3
Apprenticeship	1.1
Undergraduate degree	24
Professional qualification	7
Masters degree	8.2
PhD/ Doctorate	2.5
Other	3

Table 3

Primary Role Percentages

Primary role	**Percentage %**
Paid employment	27
Employed	5.2
Voluntary worker	1.4
Carer (non-professional)	1.1
Home-maker	3.6
Retired	6.4
Unemployed	0.6
Student	53.1
Other	1.6

3.2 Equipment

The Well-being Questionnaire

The current study used the second version of the Bristol comprehensive well-being questionnaire (Phase 2). The survey was adapted from previous well-being scales as well as other previous questionnaires which examine specific factors of well-being. The survey was based on a literature search and review of 104 scales which led to 45 domains of well-being being identified. After core academics and clinicians created Phase 1 of the questionnaire, ten clinical psychologists were paid to comment on its content. Phase 1 of the questionnaire was then trialled with 867 participants and attempted to measure all 45 domains. Analysis led to a 21-factor model of well-being. Following analysis of this earlier survey, poorly performing questions were removed, and a revised questionnaire (Phase 2) was administered. The final version of the questionnaire consisted of 492 questions including the initial consent questions.

The Phase 2 questionnaire used in the current study includes statements which ask the participants to report how strongly they agreed with a succession of statements about well-being. The questions asked about the individuals experiences and emotions over the previous six weeks, each question was on a 10-point Likert scale, most questions were rated 1 strongly disagree to 10 strongly agree or 1 not at all important to 10 extremely important. However, some questions relating to frequency of an activity were worded differently, such as 1 not at all 4 nearly every day. The questionnaire began with questions probing demographics such as age, ethnicity and schooling as well as health questions asking about aspects such as disability, illness and mental health diagnosis. The survey took on average 50 minutes to complete in one sitting, yet as the survey was online participants were able to stop and return to the questionnaire at a later time should they wish.

Internal and External questions

The current study included 12 questions which examined different aspects of internal and external focus-based frequency of internal or external focus, whether the thoughts produced were positive, negative or neutral and whether these thoughts were involuntary or voluntary. Table 4 includes the individual mind wandering questions as well as the aspect of internal cognition they aimed to measure (negative, positive, external or neutral internal cognition).

Table 4

The 12 Internal Cognition Questions

Internal Cognition Questions	**Intended Factor (Negative, Positive, External or Neutral)**
I have frequently been lost in my own thoughts which are negative/unpleasant	Negative internal/ neutral internal
I have had particular negative thoughts and preoccupations which I keep returning to	Negative internal
I feel I have had little control over the thoughts that come into my mind	Negative internal/ neutral internal
I frequently like to find a quiet place/time to contemplate things	Positive internal

I have had particular positive thoughts and preoccupations which I keep returning to	Positive internal
I have preferred living in the real world rather than in my own thoughts	External cognition
I have frequently enjoyed daydreaming and 'playing' in my own thoughts	Positive internal
I have frequently found myself lost in my own thoughts	Neutral internal
Even when I am with other people, I have frequently been lost in my own thoughts	Negative internal/ neutral internal
When I am on my own my thoughts tend to be externally focused	External cognition
When I have spoken or done things I have usually thought carefully before actually doing it	Positive internal
I have frequently been acting on autopilot and not really present in the moment	Negative internal/ Neutral internal

3.3 Procedure

Participants accessed the questionnaire via the online resource (either QR code or following the website address) using the Qualtrics software system. Participants were first directed to an introductory page which detailed the benefits and risks of the study as well as information on ethics, participant anonymity and consent. Consent had to be confirmed in order to continue with the questionnaire. Technical information was then presented regarding completing the questionnaire online, then a brief description of how to enter the prize draw.

Upon completion of the questionnaire, participants were given a debrief and information on how to enter the prize draw.

Finally, information on a number of helplines, such as Mind and the Samaritans, were listed in the event that completion of the survey has caused any distress to the participant. Following completion of the questionnaire, participants had the option to be taken to an external webpage for the prize draw. The participants are asked to generate a

unique code which would be used if they won the cash prize, an independent person was used to determine the prize draw in keeping with ethics regulations.

Chapter 4. Results

4.1 Initial Questionnaire Analyses

This section reports results of factor analyses applied to the well-being questionnaire. We expected to produce a large number of factors from the well-being questionnaire, given previous findings from Phase 1 of the questionnaire which revealed a 21-factor solution. This section also reports results of factor analysis applied to the 12 questions probing internal cognition. We expected to find positive and negative internal factors as well as a contrasting external focus factor. All factors were also assessed for internal consistency using Cronbach's alpha and these results are also presented in this chapter.

4.1.1 Factor Analysis of Well-being Questionnaire

An exploratory factor analysis of the Phase 2 questionnaire was performed, using 1045 participant's data who completed the well-being questionnaire, to reduce the well-being data into latent variables and to establish suitable constructs for future analyses. First, a parallel analysis determined the number of latent variables for the extraction, then principal axis factoring, direct oblimin rotation and a cut-off point of 0.4 was used to establish factor loading. Appropriateness for analysis was assessed by Kaiser-Meyer-Olkin values (well-being = .963) and Bartlett's test of Sphericity ($p < .001$). This produced 33 well-being factors, 29 of which were amenable to labelling (Table 5). In subsequent analyses we employ the well-being factor structure derived from 1045 participants even though analyses are restricted to 638 participants who also completed the questions related to mind wandering.

Table 5

Factor Analysis Structure of Well-being Questionnaire

Factor Label	Factor Loading	Well-being question **(During the last 6 weeks:)**

Low mood/Mild depression	0.699	I have frequently felt depressed
	0.650	I have found it hard to experience pleasure from things I usually enjoy
	0.604	I have frequently felt unhappy
	0.573	I have frequently experienced low moods
Emotional Awareness of self and others	0.627	I have been aware of the feelings and concerns of others
	0.558	I have been aware of my own feelings and emotions
Home safety	0.821	I have felt safe and secure in my home (where I live)
	0.789	I have felt safe and secure in my neighbourhood
	0.742	I would describe my home (where I live) as having been comfortable
Fatigue	0.828	Physical fatigue has frequently interfered with my daily routine
	0.815	Mental fatigue has frequently interfered with my daily routine
	0.798	I have frequently felt physically fatigued
	0.791	I have frequently felt mentally fatigued
	0.781	I have frequently felt tired and drowsy when I should have been wide awake
Motivation	-0.715	I frequently couldn't be bothered to do anything at all
	-0.700	I have spent a lot of time just doing nothing when I had things I should have been doing
	0.689	I have had the motivation to get things done
	0.638	I have been productive and able to get things done
	-0.623	I have sometimes needed prompting to get started on an activity

Social life	0.831	I have been a sociable person
	0.685	I have felt confident in social situations with people I do not know
	0.684	I have been a popular person
	0.681	I have felt satisfied with the quality of social contact I have had
	0.637	I have felt confident in social situations with people that I know well
	0.623	I have felt satisfied with the amount of social contact I have had
	-0.620	My social interactions have not been good
	0.568	I have been an easy person to get along with
Pain	0.848	I have been unable to enjoy doing my daily activities due to the pain I have experienced whilst doing them
	0.840	My daily activities have been limited by physical pain
	-0.640	I have not suffered from physical pain
	0.611	Physical health problems have interfered with my ability to perform routine activities of daily living
General Resilience	0.803	I have been able to cope well with setbacks
	0.776	I have coped well when faced with negative events
	0.656	When faced with challenging events, I have found ways to overcome them
	-0.593	I often find it difficult to bounce back following problems
	0.559	I have been optimistic about my ability to deal with life events
Financial Security	0.796	I have had enough money to pay for my wants (things beyond meeting basic 'needs'. Eg., being able to participate in

		leisure activities, buy items I want, etc.)
	-0.701	I have worried about whether I have enough money to cover all of my needs
	0.692	I have had enough money to cover all of my usual needs and responsibilities
	0.678	I have felt secure about my regular sources of income
	-0.519	I have wanted to reward/treat myself but have been unable to do so due to factors outside of my control (e.g. financial or time constraints)
	0.514	I have been saving money
Anger	0.752	I have frequently felt angry
	0.679	I have lost control of my temper and lashed out at people
	0.629	I have lost control of my temper and lashed out physically at objects
	0.591	I have felt so angry that it has interfered with my daily routine
	0.581	I have frequently felt frustrated
	0.512	I have frequently argued with one or more of those close to me
Anxiety	0.843	I have frequently avoided doing things that I wanted to do due to my anxiety
	0.840	I have frequently avoided doing things that I should have done due to my anxiety
	0.816	My anxiety has frequently interfered with my daily routine
	0.796	I have frequently avoided social situations due to my anxiety
	0.762	I have frequently felt anxious in social situations
	0.746	I have frequently experienced physical symptoms which I believed were caused by anxiety (e.g., cold or sweaty

		hands, shortness of breath, heart racing, etc.)
	0.725	I have frequently felt anxious for no obvious reason
	0.713	I have frequently felt anxious
	0.634	I have experienced panic attacks
	0.631	There have been unexpected events which have made me feel anxious
Worry about cognition	0.837	I have worried about my ability to solve problems
	0.825	I have worried about the speed of my thinking
	0.801	I have worried about my ability to pay attention and stay focused
	0.757	I have worried about my ability to make decisions
	.746	I have worried a lot about my memory ability
	0.565	I have worried a lot about my health
Self-harm/Suicidal ideation	0.840	I have sometimes felt like self-harming
	0.815	I have attempted to or engaged in self-harm
	0.786	I have had suicidal thoughts
	0.711	I have felt that my life is hardly worth living
	0.659	I have frequently felt worthless
	0.657	I have attempted or intended to commit suicide
	0.586	I have frequently felt I have nothing to look forward to
Death and Mortality	0.818	I have frequently thought about death and mortality
	0.751	I have frequently spent time wondering what life is all about
	0.699	I have wondered what would happen to people who know me, after I die
Self-esteem	0.788	I have worried about other people's opinions of me
	0.775	I have thought that others did not seem to like me

	0.761	I have had low self-esteem
	0.696	I have frequently lacked confidence in my own abilities
Goal orientation	0.743	I have worked hard to achieve the goals I have set
	0.740	I have been happy with the goals I have set myself
	0.723	I have planned my life around my goals
	0.690	I am often in control of setting my own goals
	0.610	When I reach my goals, I typically experience satisfaction
Communication	0.773	I have had no problems understanding what other people were trying to tell me
	0.677	I have had no problems speaking
Self-reward	0.796	I have treated myself to things that I like
	0.739	I have rewarded myself after achieving something
	0.657	There have been things that I have really looked forward to
Resilience for anxiety, stress and depression	0.880	I have had effective strategies for dealing with any anxieties
	0.861	I have had effective strategies for dealing with any stress
	0.808	I have had effective strategies for dealing with depression or depressive thoughts
Emotional stability	-0.810	My emotions have been very changeable
	-0.793	I have frequently experienced swings between positive and negative moods
	-0.770	I have found it hard to control my emotions
	-0.733	I have frequently struggled to cope with my own emotions
	-0.641	I have frequently experienced strong negative emotions

Positive affect	0.808	I have frequently felt cheerful or joyful
	0.769	I have frequently felt happy
	0.708	I have frequently been in a good mood
	0.681	I have felt that I lead a worthwhile life
	0.660	I have frequently felt engaged and interested in activities
	0.602	I have been satisfied with the quality of my life
	0.557	I have frequently felt calm and relaxed
	0.537	My well-being has been good
	0.533	I have frequently experienced strong positive emotions
Worry	0.793	I have spent a lot of time worrying about things
	0.746	I have worried a lot about upcoming events
	0.711	I have felt unable to control my worrying
	0.610	I have worried a lot about something bad happening to me in the future
Poor Sleep Quality	-0.715	I have been satisfied with the quality of my sleep
	0.700	I have suffered from insomnia
	0.680	I have been unable to sleep due to my mind racing as a result of stress/anxiety/tension etc.
	0.630	I have worried about coping with the day due to a lack of sleep the previous night
	-0.626	I have usually woken up fully refreshed and full of energy
Free time	-0.877	My responsibilities and commitments (e.g., as a student, worker, parent, carer, etc.) have meant that I have not had enough time for myself
	0.760	I have frequently had 'me time' to do what I wanted

	-0.698	I have not had sufficient free time to devote to those who are important to me
Social Support	0.699	I have felt supported by one or more of those close to me when needed
	0.699	I have felt like I have strong and lasting relationships with people that I know well
	0.650	I have had someone to turn to when/if needed
Communicate feelings and needs to others	-0.815	I have found it difficult to communicate my feelings to others
	-0.754	I have found it difficult to communicate my general needs to others
Concern for others	0.684	I have often been concerned about the well-being of those close to me
	0.622	I have often been concerned about the well-being of those who are not close to me
Vengefulness	0.582	When someone has annoyed or upset me I have taken revenge in some way
	0.533	I have been a manipulative person
Stress	0.745	I have frequently felt stressed
	0.728	There have been a lot of things causing me stress
	0.699	I have frequently experienced physical symptoms which I believed were caused by stress (e.g., difficulty sleeping, feeling physically tense, having headaches, etc.)

Note. Factors smaller than < 0.4 supressed

4.1.2 Factor Analysis of Internal Cognition Questions

A factor analysis was also performed for the 12 internal cognition questions (see Table 6). As with the well-being item factor analysis principal axis factoring was used, direct oblimin rotation and a cut-off point of 0.4 to establish item loading. Appropriateness for

analysis was assessed by Kaiser-Meyer-Olkin values (internal cognition = .830) and Bartlett's test of Sphericity ($p < .001$). This produced four internal cognition factors involving 9 of the 12 internal questions. The three questions that were rejected by the factor analysis were: "when I am on my own my thoughts tend to be externally focused", "when I have spoken or done things I have usually thought carefully before actually doing it" and "I have frequently been acting on autopilot and not really present in the moment.

Table 6

Factor Analysis Structure of Internal Cognition Questions

Internal Cognition Question	Factor Loading	Factor
I have frequently been lost in my own thoughts which are negative/unpleasant	.885	1, Negative Internal
I have had particular negative thoughts and preoccupations which I keep returning to	.828	1
I feel I have had little control over the thoughts that come into my mind	.676	1
I frequently like to find a quiet place/time to contemplate things	.579	2, Positive Internal
I have had particular positive thoughts and preoccupations which I keep returning to	.427	2
I have preferred living in the real world rather than in my own thoughts	.608	3, External Cognition
I have frequently enjoyed daydreaming and 'playing' in my own thoughts	-.544	3
I have frequently found myself lost in my own thoughts	.435	4, Neutral Internal
Even when I am with other people, I have frequently been lost in my own thoughts	.424	4

Note. Factors < 0.4 were supressed

4.1.3 Cronbach's Alpha Well-being and Internal Cognition Factors

Following the factor analyses, Cronbach's Alpha test was performed for the well-being factors and internal cognition factors in order to assess the internal consistency of each of the factors. The results of the well-being factors are displayed in Table 7, the

internal factors in Table 8. All values found at 0.7 or higher were classed as a high level of internal consistency (DeVillis, 2003; Kline, 2005).

Table 7

Cronbach's Alpha for Well-being Factors

Well-being factor	Cronbach's Alpha
Low mood/Mild depression	**0.927**
Emotional awareness of self and others	0.638
Home safety	0.813
Fatigue	0.917
Motivation	**0.844**
Social life	0.893
Pain	0.809
General resilience	0.857
Financial security	0.803
Anger	0.833
Anxiety	**0.942**
Worry about cognition	0.891
Self-harm/Suicidal ideation	0.911
Death and Mortality	0.822
Self esteem	0.889
Goal orientation	0.828
Communication	0.714
Self-reward	0.788
Resilience for anxiety, stress and depression	0.907
Emotional stability	0.902
Positive Affect	**0.917**
Worry	0.909
Poor Sleep quality	**0.828**
Free time	0.816
Social support	0.783
Communicate needs and feelings to others	0.766
Concern for others	0.670
Vengefulness	0.624
Stress	**0.865**

Note. Factors in bold are relevant to the current study

Table 8

Cronbach's Alpha Internal Cognition Factors

Internal cognition factor	Cronbach's Alpha
Negative internal	0.857
Positive internal	0.400
External cognition	0.707
Neutral internal	0.429

Discussion 4.1.4

Well-being questionnaire

The well-being questionnaire produced 29 factors which were amenable to labelling. The factor structure established in the current study was similar to Phase 1. However, depression was dissociated into two distinct categories in Phase 2; low mood/mild depression and self-harm/ suicidal ideation. Here we focused on the depression factor and ignored self-harm/suicidal ideation because the latter factor was not predicted. The large factor structure produced may reflect the efforts made to probe a wide variety of distinct components of well-being in the questionnaire (45 domains in total). It is important to note that the large number of factors is at variance with previous literature and suggests that many other scales address a far smaller set of issues and concerns relating to well-being.

The well-being factors specifically chosen in the current study were low mood/ mild depression, anxiety, poor sleep quality, stress, positive affect and motivation. These factors were chosen to be analysed in relation to internal cognition due to their previously associated affiliations with mind wandering (see introduction). Depression, anxiety, sleep quality and stress have all been found to be associated with the presence of increased internalisation to influence poor well-being. Whereas, in contrast positive affect and motivation have previously been associated with increased well-being via increased positive thoughts and external focus. All of the well-being factors chosen include high factors scores and have high Cronbach's alpha confirming reliability within the well-being questionnaire.

Internal questions

A factor analysis was performed for the 12 internal cognition questions. As previously mentioned, 9 of the 12 questions were involved in the four-factor solution. As expected in Hypothesis 1, we established positive and negative internal factors and a contrasting external focus factor. We also produced a neutral internal factor which represented frequent internal cognition regardless of content. The three questions that were rejected by the factor analysis were: "when I am on my own my thoughts tend to be externally focused", "when I have spoken or done things I have usually thought carefully before actually doing it" and "I have frequently been acting on autopilot and not really present in the moment.

Factors labels were assigned relating to the nature of the factor and what the author understood it to be portraying (see Table 6). The three questions in the first factor probed feelings that one has been frequently lost in negative thoughts, as well as a sense of uncontrollability within those negative thoughts and preoccupations. This first factor was therefore labelled “Negative Internal”. It is interesting to note that the question “I feel I have had little control over the thoughts that come into my mind” loaded on the negative thoughts group, suggesting that negative thoughts, rather positive thoughts, were uncontrollable. The second factor included questions which related to positive thoughts and a desire to assign time to contemplation. This factor was therefore named “Positive Internal”. The third factor probed a preference to focus on the ‘real world’ rather than being in one’s own thoughts, as well as enjoying being in one’s own thoughts (this question had a negative factor loading). The factor was therefore labelled “External Cognition” indicating that a higher score reflects a preference for the external over internal world. There were concerns regarding the question “I have preferred living in the real world rather than in my own thoughts” as this could suggest that one prefers living in the ‘real world’ because they enjoy being externally focused and engaging in external activities, or on the other hand it could suggest that they prefer living in the ‘real world’ because the ‘internal world’ or their internal thoughts are unpleasant and they wish to escape them. Because of this ambiguity, in future discussions on significant findings, both interpretations are explored. The final factor included questions which asked about more general experiences of internal thoughts, specifically the frequency of being lost in thought and how often this occurred when with company. It is important to note that the questions in the fourth factor do not preclude positive or negative thoughts but were established as statistically distinct separate factor and therefore may explain something further about internal cognition that positive and negative thought do not. This means that frequently being lost in thought does not have to be strictly negative or positive, and this factor was termed “neutral internal” to reflect the fact that it probed internal cognition in a non-valenced way (i.e. neither negative or positive). Table 6 displays the four internal cognition factors including their assigned labels. The factor loadings describe how strongly associated each question is to its assigned factor, higher loadings indicate a stronger relationship.

Considerably lower factor loadings were found for the neutral internal factor and low Cronbach's alpha was presented for positive internal and neutral internal, suggesting low reliability within the questionnaire. However, some previous scholars have suggested that in early stages of research in the social sciences, lower values are sufficient as they examine widely diverse constructs (Nunnally, 1978). Therefore, both of the factors were included in the current study.

4.2 Initial Analyses of Internal Cognition Questions

In this section frequencies of scores on the 9 internal cognition questions are presented to address whether, as predicted by previous research (Killingsworth & Gilbert, 2010), participants report frequent mind wandering. The internal cognition questions are then examined in relation to their correlations with each other. Prior to examining intercorrelations, however, we assigned the internal cognition questions truncated labels for ease of reading in the remaining analyses. Analysis of intercorrelations is a critical step because understanding relationships between the internal cognition questions provides clues about whether they probe related or distinct elements of experience. These intercorrelations explored relations between all 9 individual questions and also between each of the four internal cognition factors.

4.2.1 Frequencies of Internal Cognition

Frequencies of scores from the 9 internal cognition questions were examined. Scores were separated into upper and lower halves and chi-squared analyses were performed to establish significant differences between the two groups.

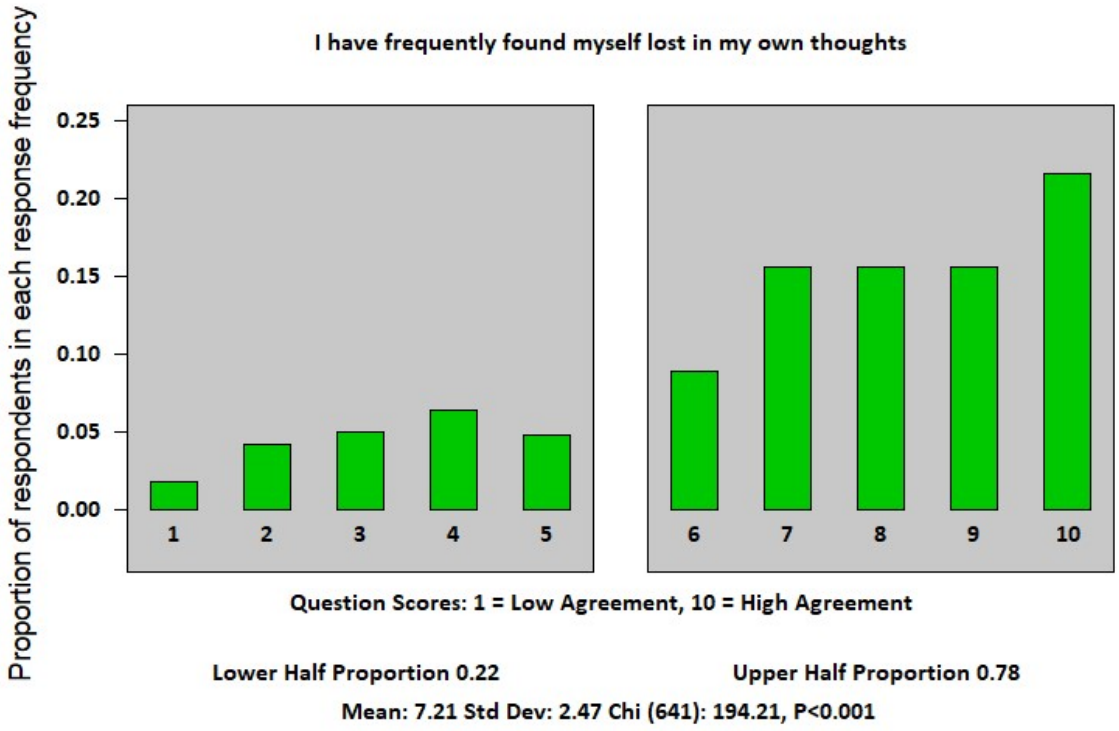

Figure 2 Frequencies of scores for "I have frequently found myself lost in my own thoughts"

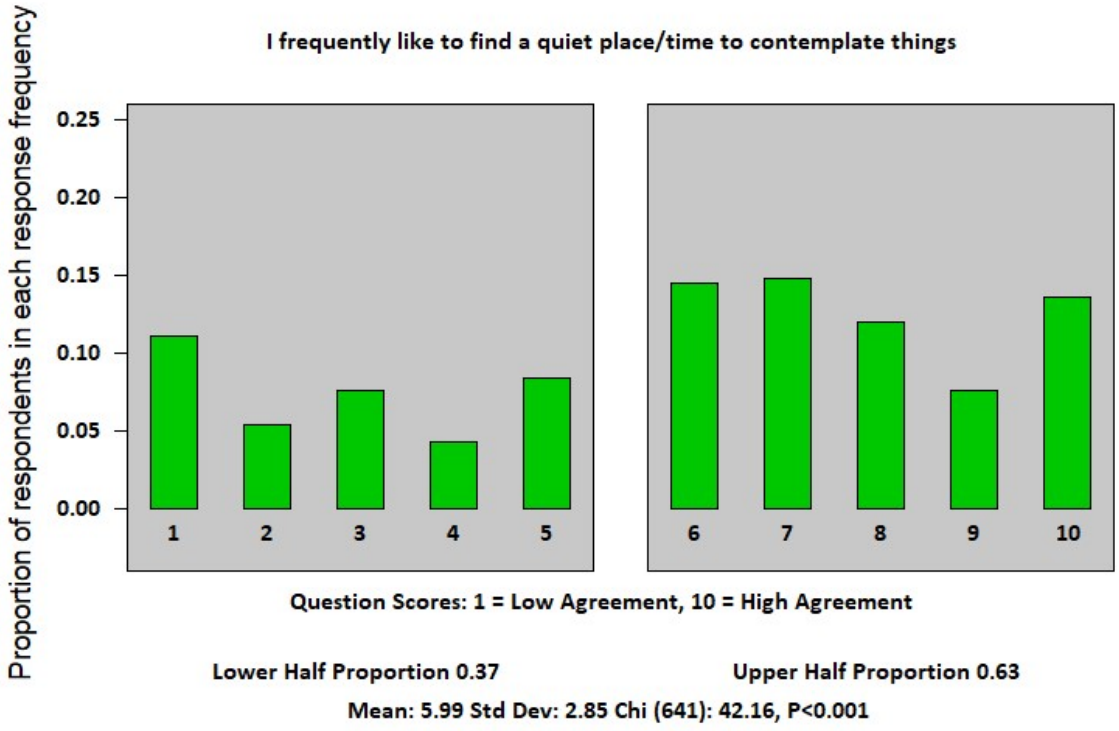

Figure 3 Frequencies of scores of "I frequently like to find a quiet place/time to contemplate things"

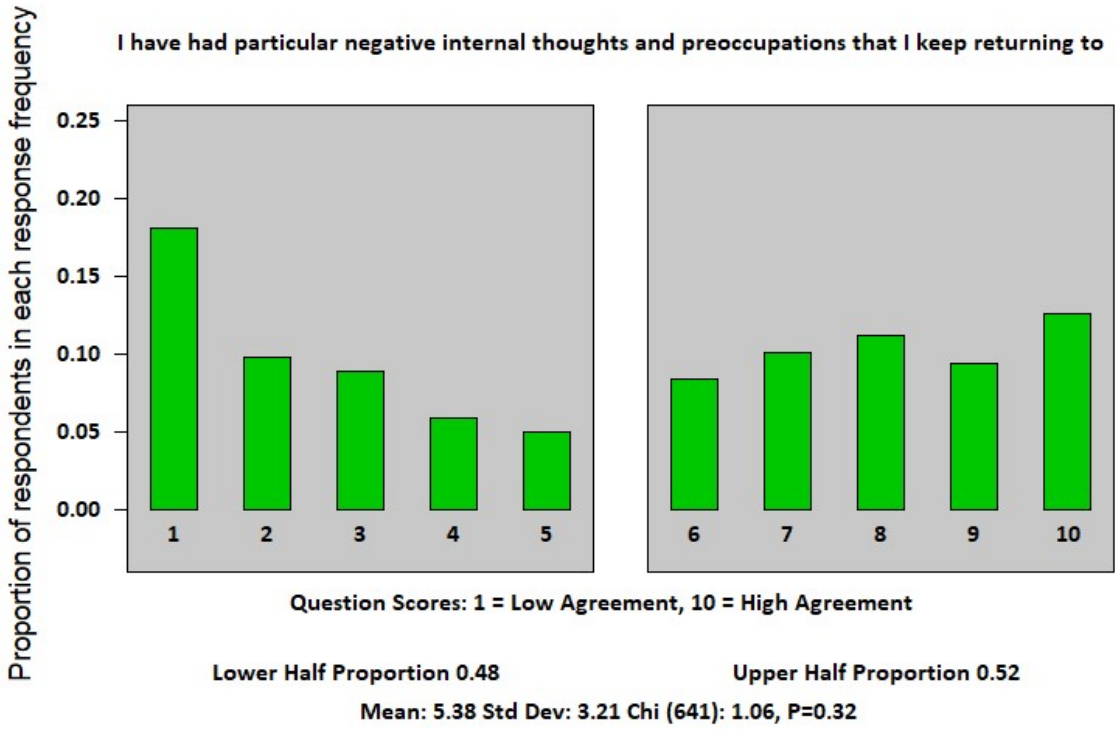

Figure 4 Frequencies of scores of "I have had particular negative internal thoughts and preoccupations that I keep returning to"

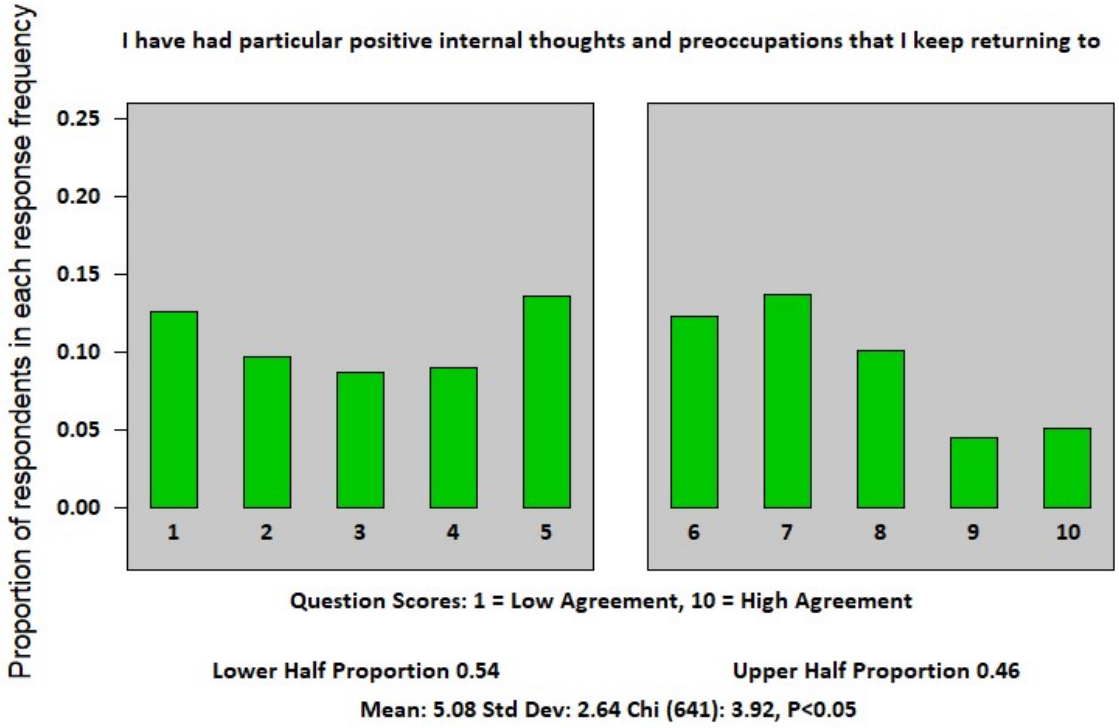

Figure 5 Frequencies of scores of "I have had particular positive internal thoughts and preoccupations that I keep returning to"

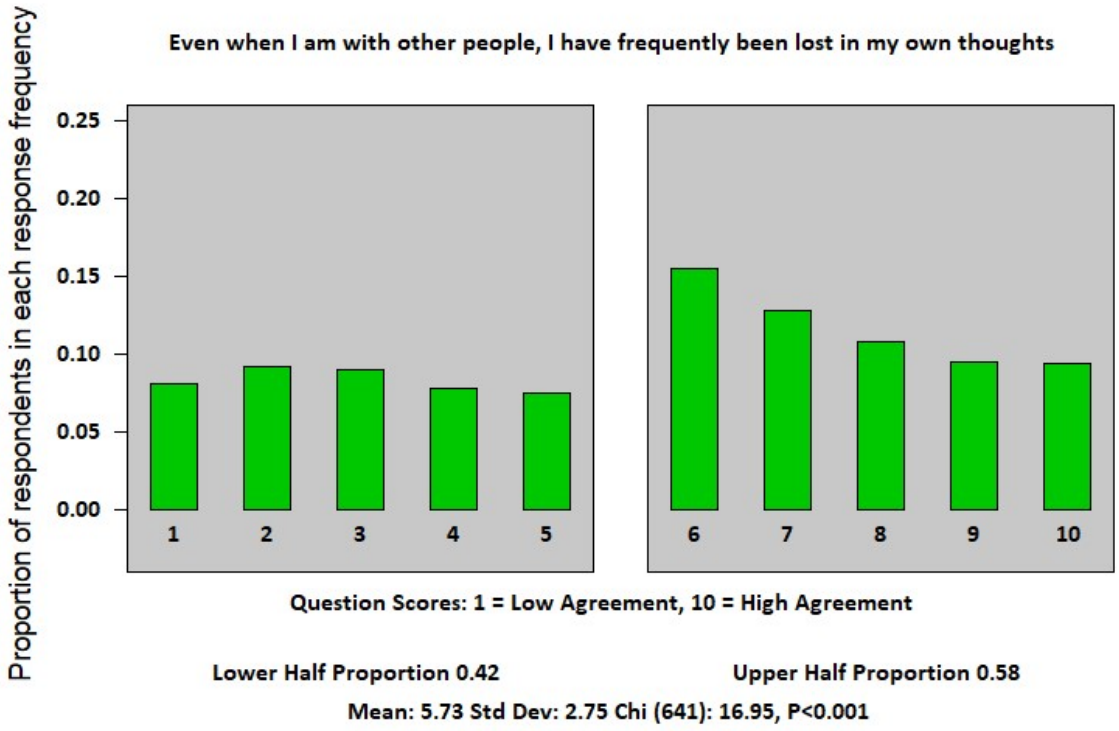

Figure 6 Frequencies of scores of "Even when I am with other people, I have frequently been lost in my own thoughts"

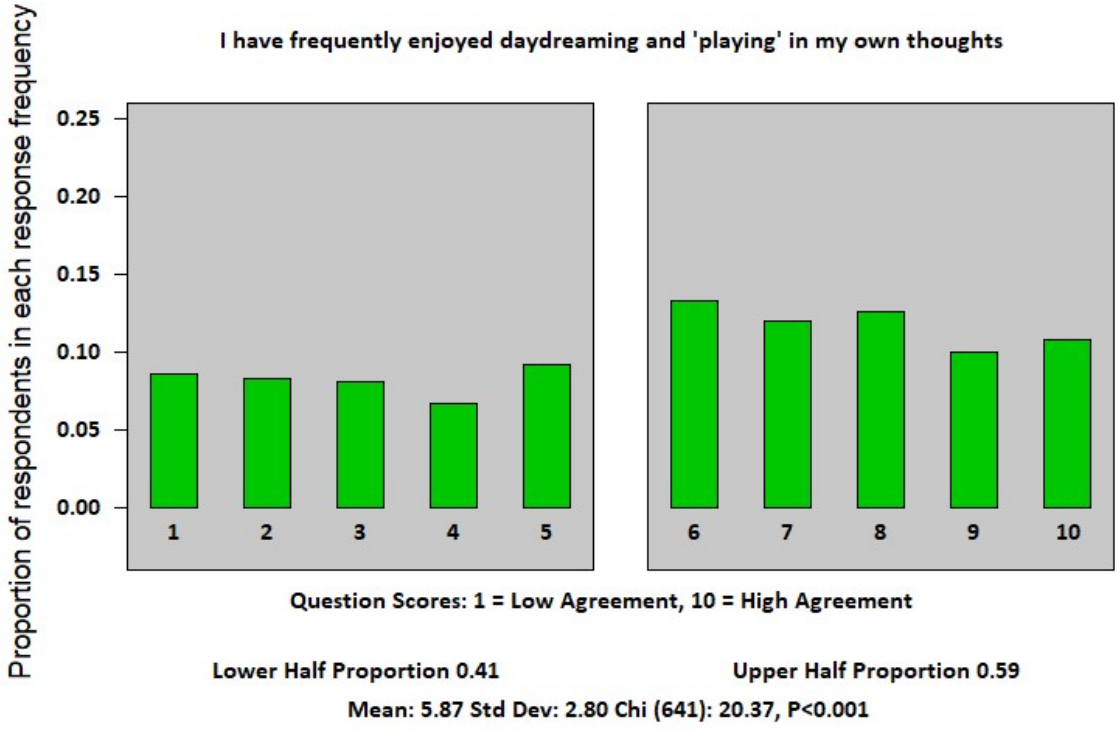

Figure 7 Frequencies of scores of "I have frequently enjoyed daydreaming and 'playing' in my own thoughts"

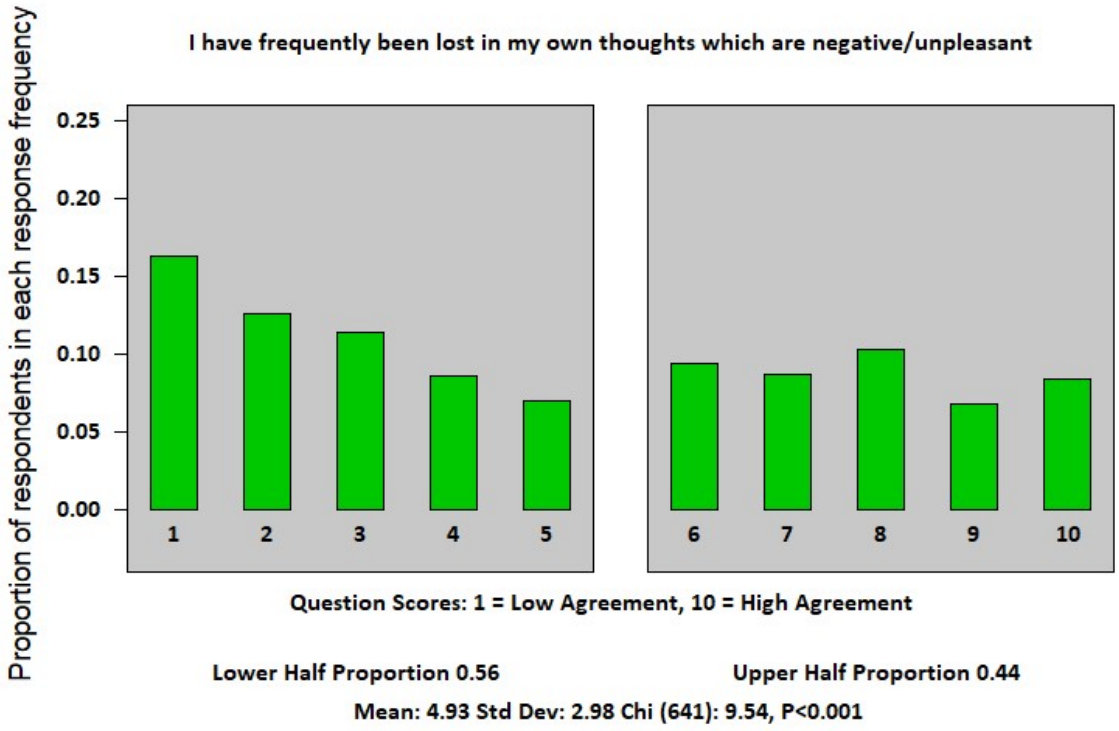

Figure 8 Frequencies of scores of "I have frequently been lost in my own thoughts which are negative/unpleasant"

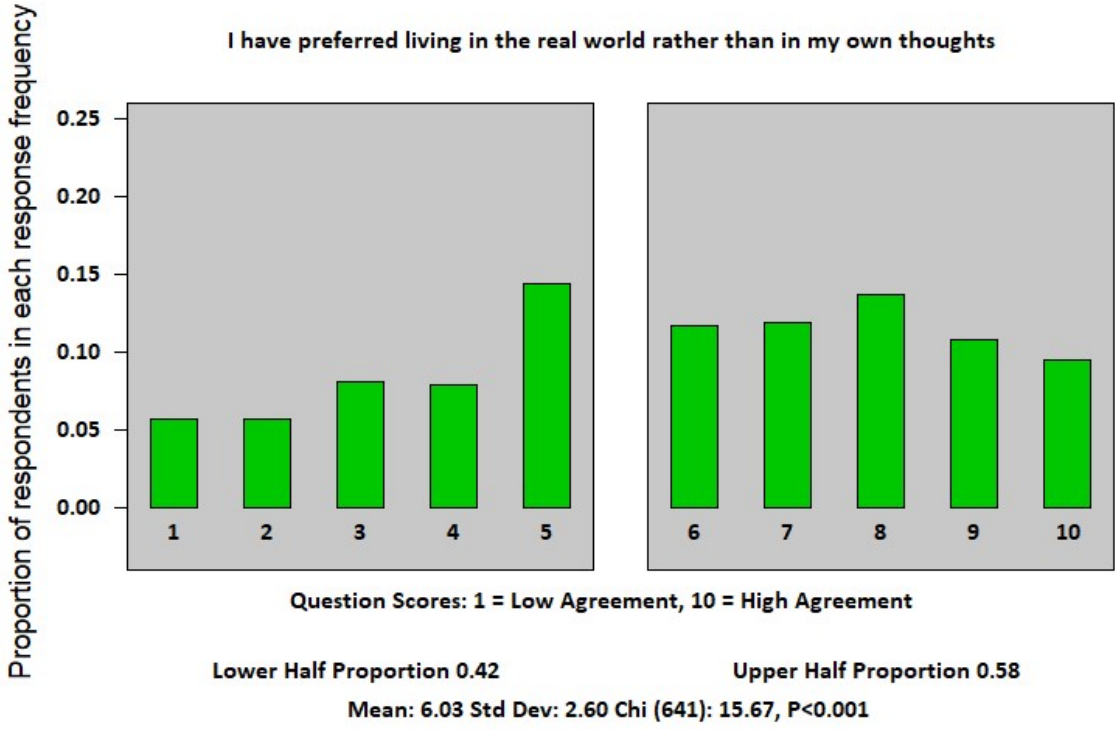

Figure 9 Frequencies of scores of "I have preferred living in the real world rather than in my own thoughts"

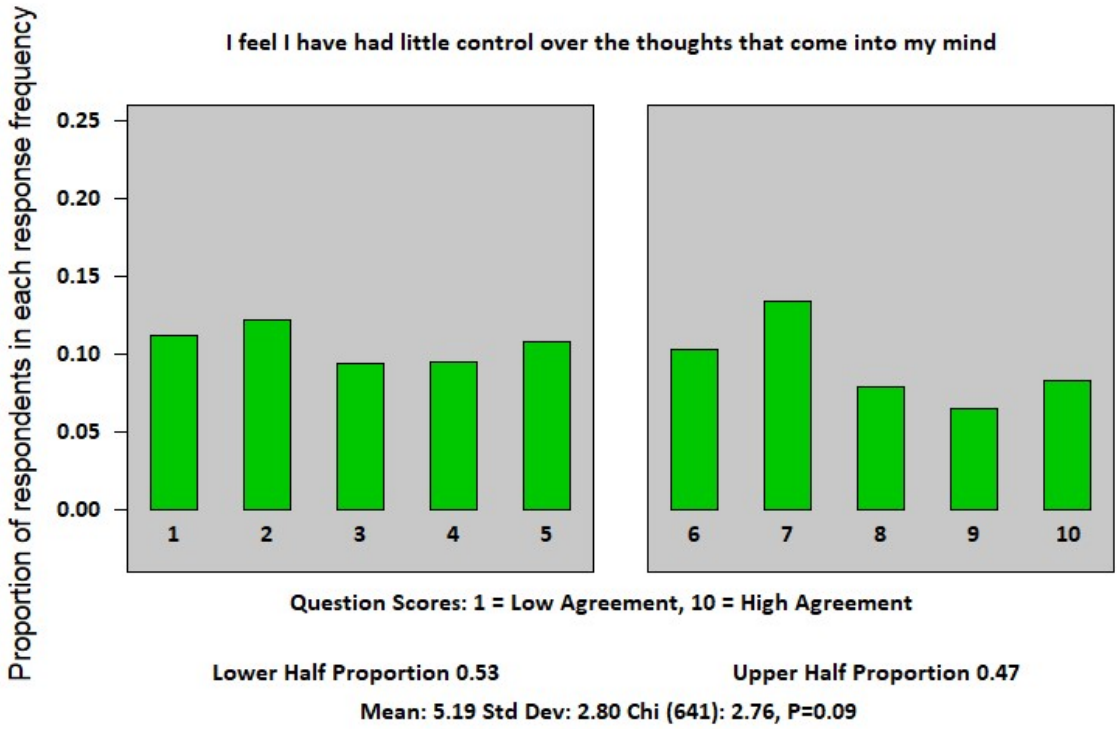

Figure 10 Frequencies of scores of "I feel I have had little control over the thoughts that come into my mind"

4.2.2 Internal Cognition Questions Truncated variable names

In future analyses the 9 internal cognition questions were individually analysed. As the questions are long in length, they were assigned a shortened label for clarity within future tables. Please consult Table 9 below for each question.

Table 9

Internal Cognition Questions and Assigned Question Number and Label

Question	Shortened Label
I have frequently found myself lost in my own thoughts	Frequently lost in thoughts
I frequently like to find a quiet place/time to contemplate things	Like quiet to contemplate
I have had particular negative thoughts and preoccupations which I keep returning to	Frequent negative preoccupations
I have had particular positive thoughts and preoccupations which I keep returning to	Frequent positive preoccupations

Even when I am with other people, I have frequently been lost in my own thoughts	Lost in thoughts with others
I have frequently enjoyed daydreaming and 'playing' in my own thoughts	Enjoyed daydreaming
I have frequently been lost in my own thoughts which are negative/unpleasant	Frequent negative thoughts
I have preferred living in the real world rather than in my own thoughts	Prefer living in real world
I feel I have had little control over the thoughts that come into my mind	Little control over thoughts

4.2.3 Internal Factors Correlations

A Pearson's correlation was performed with the internal cognition factors (see Table 10).

Table 10

Correlations of internal factors

		Negative-Internal	Positive-Internal	External Cognition	Neutral-Internal
Negative-Internal	Pearson Correlation	1	-.083*	-.274**	.632**
	Sig. (2-tailed)		.036	.000	.000
Positive-Internal	Pearson Correlation	-.083*	1	-.079*	.027
	Sig. (2-tailed)	.036		.047	.503
External Cognition	Pearson Correlation	-.274**	-.079*	1	-.461**
	Sig. (2-tailed)	.000	.047		.000
Neutral-Internal	Pearson Correlation	.632**	.027	-.461**	1
	Sig. (2-tailed)	.000	.503	.000	

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed)

4.2.4 Internal Cognition Questions Correlations

A Pearson's correlation was performed including the 9 internal cognition questions (Table 11). Previous analyses demonstrated that Cronbach's Alpha and factor analysis loadings were lower for the positive internal and neutral internal factors. For this reason, correlations between the internal cognition questions might deliver further insights into their relationships.

Table 11

Internal Cognition Questions Correlations

	Frequently lost in thoughts	Like quiet to contemplate	Frequent negative preoccupations	Frequent positive preoccupations	Lost in thoughts with others	Enjoyed daydreaming	Frequent negative thoughts	Prefer living in the real world	Little control over thoughts
Frequently lost in thoughts	1.000	.123**	.477**	-.091*	.550**	.412**	.518**	-.212**	.408**
Like quiet to contemplate	.123**	1.000	.100**	.253**	.128**	.173**	.068*	-.012	-.007
Frequent negative preoccupations	.477**	.100**	1.000	-.143**	.487**	.223**	.760**	-.192**	.581**
Frequent positive preoccupations	-.091*	.253**	-.143**	1.000	-.103*	.134**	-.189**	.143**	-.217**
Lost in thoughts with others	.550**	.128**	.487**	-.103*	1.000	.455**	.564**	-.200**	.483**
Enjoyed daydreaming	.412**	.173**	.223**	.134**	.455**	1.000	.271**	-.274**	.168**
Frequent negative thoughts	.518**	.068*	.760**	-.189**	.564**	.271**	1.000	-.207**	.661**

Prefer living in the real world	-.212**	-.012	-.192**	.143**	-.200**	-.274**	-.207**	1.000	-.082*
Little control over thoughts	.408**	-.007	.581**	-.217**	.483**	.168**	.661**	-.082*	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed)

4.2.5 Discussion

Frequencies of scores on the internal cognition questions were examined in order to establish whether the individuals in our sample spent frequent amounts of daily life mind wandering and whether the content of this internal cognition was positive or negative. Results clearly showed that the majority of people spend frequent amounts of time lost in thoughts. Scores from "I have frequently found myself lost in my own thoughts" mostly land on the upper half of the scale and the Chi-square value shows a significant difference between the two sections ($X^2 = 169.61$, $p < 0.0001$). Similarly, results indicated that people are frequently lost in thoughts even when with others. These findings support hypothesis 2.2.1.

Findings also showed that a significant proportion of people frequently like to find a quiet place to contemplate and enjoy daydreaming. In contrast, results showed that, on average people do not have frequent positive or negative thoughts. Finally, people prefer to spend time in the real world rather than internally focused.

No significant difference in high and low scores were found for "I have had particular negative internal thoughts and preoccupations that I keep returning to" or "I feel I have had little control over the thoughts that come into my mind".

A Pearson's correlation examined relationships between the internal cognition factors. In general, the factors behaved as expected; Negative internal positively correlated with neutral internal. Negative internal negatively correlated with positive internal confirming that the less positive thoughts one has the more negative ones occur. However, this correlation is very small and therefore is only a small shared variance (-.083). A negative

correlation was also found between negative internal and external cognition, confirming that increased external focus reduces negative thoughts. In contrast to our predictions positive internal negatively correlated to external cognition. The correlation is small so does not show much shared variance, however, this negative correlation between positive internal cognition and external cognition is most likely due to the negative correlations between individual questions within these factors, mainly “prefer living in the real world” in the external cognition factor and “like quiet to contemplate” in the positive internal factor. Finally, external cognition negatively correlated with neutral internal, further supporting the hypothesis that increased external focus decreases mind wandering.

As expected, “Frequently lost in thoughts” positively correlated with the negative internal questions “Frequent negative thoughts”, “frequent negative preoccupations” and “little control over thoughts”. As well as the remaining neutral internal question “lost in thoughts with others” and the external question “enjoyed daydreaming”. The positive internal question “like quiet to contemplate” also had a positive correlation with “frequently lost in thoughts” yet was much smaller. A small negative correlation was found for “frequent positive preoccupations”. Confirming our hypotheses, a negative correlation was found between “frequently lost in thoughts” and “prefer living in the real world”. This strengthens the argument that those who prefer to spend time externally focused are less likely to be lost in thought.

“Lost in thoughts with others” also positively correlated with “frequent negative thoughts”, “frequent negative preoccupations” and “little control over thoughts”. Similar to “frequently lost in thoughts”, “lost in thought with others” also positively correlated with “enjoyed daydreaming” and “like quiet to contemplate”. This finding confirms a positive relationship between frequent mind wandering and enjoying spending time in thoughts. A small negative correlation was found with “frequent positive preoccupations”.

“Like quiet to contemplate”, as predicted, positively correlated with “frequent positive preoccupations” and “enjoyed daydreaming”, adding to the finding that positive mind wandering is associated with deliberate internal cognition. There was also a small positive correlation between “like quiet to contemplate” and “frequent negative thoughts” and “frequent negative preoccupations”. A small negative correlation was found between “like quiet to contemplate” and “little control over thoughts”. Finally, a negative correlation

was found with “prefer living in the real world” and “like quiet to contemplate” suggesting that those who are more externally focused spend less time engaged in internal cognition.

Negative correlations were found between “frequent positive preoccupations” and “frequent negative thoughts” and “frequent negative preoccupations” and “little control over thoughts”. This confirmed predictions which propose that the more positive thoughts one has, the less negative thoughts occur. Positive correlations were found between “frequent positive preoccupations” and “enjoyed daydreaming” which is understandable as it is reported as a positive experience so positive thoughts are likely to be present. As expected, a positive correlation was also found between “frequent positive preoccupations” and “prefer living in the real world” suggesting that, although one is less likely to have frequent internal thoughts when one is mostly externally focused, being externally focused is associated with increased positive thoughts. This is consistent with previous research exploring the positive effects of being externally focused (Nix, Watson, Pyszczynski and Greenberg, 1995),

Following this, “prefer living in real world” negatively correlated with all remaining questions; “frequent negative thoughts”, “frequent negative preoccupations”, “little control over thoughts” and “enjoyed daydreaming”. This supports our predictions that those who are more externally focused experience less frequent internal thoughts.

“Enjoyed daydreaming” interestingly positively correlated with all questions except “prefer living in the real world”, remaining unreported correlations are “frequent negative thoughts”, “frequent negative preoccupations” and “little control over thoughts”. A potential viewpoint could be that people enjoy spending time in negative thoughts, however, this is unlikely due to consistent previous findings displaying the negative impact of negative internal thoughts upon well-being (Killingsworth & Gilbert, 2010). One could also confirm from these findings that if one spends their time frequently lost in thought that this can be both negative and positive in equal measure.

Lastly, the negative internal questions positively correlated with each other as expected. “Frequent negative thoughts” positively correlated with “frequent negative preoccupations” and “little control over thoughts” and “frequent negative preoccupations” positively correlated with “little control over thoughts”. This implies a strong relationship

between the occurrence of negative thoughts and their uncontrollability, consistent with previous literature and the current study predictions.

4.3 Relationship Between Internal Cognition Questions and Well-being

In this section the influences of the individual internal cognition questions upon well-being are examined. First, a Pearson's correlation between the well-being factors was performed to indicate how the factors relate to one another. This is important because multiple regression can mask intercorrelations between variables and permits a more meaningful interpretation of regression analyses (e.g. predictors that are non-significant may still correlate with the dependent variable but share variance with one or other predictors). Next, multiple regression analyses were conducted with the internal cognition questions predicting the well-being factors. Dominance analyses (Darlington and Hayes, 2016) were also conducted in order to assess which of the questions were a more powerful predictor of the well-being factors.

4.3.1 Effect size and dominance analysis

Dominance analysis (Azen and Budescu, 2003; Darlington and Hayes, 2016) provides a mechanism for placing regressors in order of their capacity to improve the fit of the model. That is, the order that predicts the highest value of r^2. For any two predictors A and B, their contrasting capacity to improve r^2 may reflect three possibilities, A>B, B>A or A=B (equivalent levels of improvement). Consider a regression with 5 predictors: A, B, C, D, E. In order to establish the relative dominance of A and B, these are pitted against each other in 8 separate regressions A alone, AxC, AxD, AxE, AxCxD, AxCxE, AxDxE, AxCxDxE and this process is repeated for B: B alone, BxC, BxD, BxE, BxCxD, BxCxE, BxDxE, BxCxDxE. Moreover, this process is iterated for all paired combinations of variables of the K variables. Results of these iterations determine which variable provides the most dominance in terms of r^2 fit. Dominance values vary between 0 (no dominance) and 1 (complete dominance). Intermediate values or "partial dominance" lie in the range 0 to 1. The range of intermediate values depends on the number of possible contrasts. For four regressors possible values restricted to 0, 0.25, 0.5, 0.75 and 1. The precise number reflects the proportion of all cases in which A outperformed B in all subsets regression. It is important to

note that when dominance is computed, A and B are never compared with each other directly (dominance instead reflects the overall proportion of occasions when A outperforms B). When a predictor has complete dominance over all other regressors (all values =1) it can therefore be regarded as the most important predictor. In this sense, dominance provides a measure of relative effect size, that is, relative to predictive power of all regressors. Dominance analyses in this thesis employed the Hayes RLM SPSS macro.

When reporting regression models, effect size is based upon computing Cohen's F^2 (Cohen, 1988) when applied to the overall model r^2. While this measure has limitations (see Darlington and Hayes, 2016) it does produce a measure that is frequently reported in the literature. F^2 essentially reflects the amount (strictly, the ratio) of variance in the outcome variable that can be uniquely attributed to the predictor(s). F^2 is not defined as a proportion because values can exceed 1 (minimum possible value = 0). F^2 can also be calculated for a single correlation between two variables. F^2 is typically divided into three levels of effect size, small F^2>0.02, medium F^2 >0.15 and large, F^2>0.35. A value of 0.35 would reflect that a regressor(s) predicts 26% of the variance in the outcome value.

4.3.2 Correlations Between Individual Well-being Factors

As mentioned previously, Cronbach's Alpha of the neutral internal and positive internal factors were relatively low, and both have low factor loadings. For this reason, multiple regressions were performed with the individual questions predicting well-being in recognition that some of the factors had suboptimum internal consistency and that regressions employed at the level of individual questions might reveal a clearer picture. Similarly, the study predictions were constructed prior to the confirmation of a four-factor model of internal cognition, therefore by examining the individual questions effects upon well-being we can potentially improve understanding of the factors and their relationship to well-being.

An initial exploratory Pearson's correlation was performed to better understand the relationship between the chosen well-being factors irrespective of mind wandering facets (Table 12).

Table 12

Correlations between the Well-being Factors

Correlations

		Low mood-Mild depression	Anxiety	Poor Sleep Quality	Stress	Positive Affect	Motivation
Low mood-Mild depression	Pearson Correlation	1	.683**	.539**	.653**	-.785**	-.510**
Anxiety	Pearson Correlation	.683**	1	.548**	.598**	-.572**	-.450**
Poor Sleep Quality	Pearson Correlation	.539**	.548**	1	.552**	-.511**	-.462**
Stress	Pearson Correlation	.653**	.598**	.552**	1	-.527**	-.391**
Positive Affect	Pearson Correlation	-.785**	-.572**	-.511**	-.527**	1	.484**
Motivation	Pearson Correlation	-.510**	-.450**	-.462**	-.391**	.484**	1

**. Correlation is significant at the 0.01 level (2-tailed).

The well-being factors most associated with poor well-being positively correlated with each other (low mood/ mild depression, anxiety, poor sleep quality and stress) and the well-being factors associated with positive well-being positively correlated with each other (positive affect and motivation). Finally, as predicted negative correlations were found between poor well-being factors (low mood/mild depression, anxiety, poor sleep quality and stress) and positive well-being factors (positive affect and motivation).

4.3.3 Multiple Regressions of Internal Questions Predicting Well-being Factors

Multiple regressions were performed with the individual internal cognition questions predicting the chosen well-being factors. A dominance analysis of the internal cognition questions was also performed for each well-being factor.

The regression assumptions are written in full for the first regression analyses (internal cognition questions predicting low mood/mild depression). For all subsequent analyses satisfaction of regression assumptions are displayed in Table 13 below. All subsequent regression assumptions in future chapters will also be displayed in this format at the beginning of the chapter.

Table 13

Multiple Regression Assumption Tests for Predicting Well-being Factors from Internal Cognition Questions

	Linearity	Durbin-Watson	Homoscedasticity	Multicollinearity	Studentized deleted residuals	Leverage points	Influential Points (Cook's	Assuption of normality
Anxiety	Yes	2.044	Yes	No	No	No	No	Yes
Sleep quality	Yes	2.037	Yes	No	No	No	No	Yes
Stress	Yes	1.931	Yes	No	No	No	No	Yes
Positive affect	Yes	1.921	Yes	No	No	No	No	Yes
Motivation	Yes	1.808	Yes	No	No	No	No	Yes

Low mood/ mild depression

A multiple regression was performed to predict low mood/mild depression from the internal cognition questions. Table 14 shows correlations between the internal questions and low mood/mild depression, a majority of the questions correlated with low mood/mild depression. The multiple regression model significantly predicted Low mood/mild depression, $F(9,628) = 75.757$, $p < .001$, adj. $R^2 = .521$, Cohen's $f^2 = 1.088$ representing a large effect size Cohen (1988). Questions "I have frequently found myself lost in my own thoughts", "I have had particular negative thoughts and preoccupations which I keep returning to", "I have had particular positive preoccupations which I keep returning to", "I have frequently enjoyed daydreaming and 'playing' in my own thoughts", "I have frequently been lost in my own thoughts which are negative/unpleasant", "I have preferred living in the real world rather than in my own thoughts" and "I have had little control over the thoughts that come into my mind" all added significantly to the prediction, $p < .05$.

Table 14

Internal Cognition Questions Predicting Low mood/Mild Depression Correlations

	Low mood-Mild depression	Frequently lost in thoughts	Like quiet to contemplate	Frequent negative preoccupations	Frequent positive preoccupations	Lost in thought with others	Enjoyed daydreaming	Frequent negative thoughts	Prefer living in the real world	Little control over thoughts

Low mood-Mild depression	1.000	.448**	.025	.654**	-.264**	.424**	.129**	.640**	-.222**	.516**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 15

Internal Cognition Questions Predicting Low Mood/Mild Depression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	8.756	.373		23.479	.000
	Frequently lost in thoughts	.133	-.039	.125	3.458	.001
	Like quiet to contemplate	-.000	-.027	-.000	-.006	.995
	Frequent negative preoccupations	.288	-.036	.349	7.991	.000
	Frequent positive preoccupations	-.114	-.030	-.114	-3.771	.000
	Lost in thoughts with others	.036	-.037	.037	.966	.335
	Enjoyed daydreaming	-.092	-.032	-.098	-2.916	.004
	Frequent negative thoughts	.199	-.043	.224	4.572	.000
	Prefer living in the real world	-.080	-.030	-.079	-2.656	.008
	Little control over thoughts	.076	-.036	.081	2.103	.036

a. Dependent Variable: Low mood/Mild depression

Table 16

Dominance Analysis of Internal Questions Predicting Low Mood/Mild Depression

	Frequentlylostinthoughts	Likequiettocontemplate	Frequentnegativepreoccupations	Frequentpositivepreoccupations	Lostinthoughtswithothers	Enjoyeddaydreaming	Frequentnegativethoughts	Preferlivinginthereworld	Littlecontroloverthoughts
Frequently lost in thoughts	.000	1.000	.000	.438	1.000	.969	.000	1.000	.570
Like quiet to contemplate	.000	.000	.000	.000	.102	.086	.000	.000	.000

Frequent negative preoccupations	**1.000**	**1.000**	.000	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
Frequent positive preoccupations	.563	1.000	.000	.000	.844	1.000	.039	.930	.680
Lost in thoughts with others	.000	.898	.000	.156	.000	.531	.000	.289	.000
Enjoyed daydreaming	.031	.914	.000	.000	.469	.000	.000	.328	.188
Frequent negative thoughts	1.000	1.000	.000	.961	1.000	1.000	.000	1.000	1.000
Prefer living in the real world	.000	1.000	.000	.070	.711	.672	.000	.000	.156
Little control over thoughts	.430	1.000	.000	.320	1.000	.813	.000	.844	.000

Note. The most dominant predictor is highlighted in bold.

Anxiety

A multiple regression was performed to predict anxiety from the internal cognition questions. The multiple regression model significantly predicted Anxiety, $F(9,628) = 51.142$, $p < .001$, adj. $R^2 = .423$, Cohen's $f^2 = 0.733$ representing a large effect size Cohen (1988). Questions "I have had particular negative internal thoughts and preoccupations that I keep returning to", "Even when I am with other people, I have frequently been lost in my own thoughts" and "I have frequently been lost in my own thoughts which are negative/unpleasant" added significantly to the prediction, $p < .05$. Table 17 shows correlations between the internal questions and anxiety, a majority of the questions correlated with anxiety.

Table 17

Internal Cognition Questions Predicting Anxiety Correlations

	Anxiety	Frequently lost in thoughts	Like quiet to contemplate	Frequent negative preoccupations	Frequent positive preoccupations	Lost in thought with others	Enjoyed daydreaming	Frequent negative thoughts	Prefer living in the real world	Little control over thoughts
Anxiety	1.000	.408**	.085*	.581**	-.163**	.475**	.192**	.593**	-.189**	.453**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 18

Internal Cognition Questions Predicting Anxiety Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	9.648	.388		24.894	.000
	Frequently lost in thoughts	.054	-.040	.053	1.344	.180
	Like quiet to contemplate	.030	-.028	.034	1.069	.285
	Frequent negative preoccupations	.205	-.037	.263	5.483	.000
	Frequent positive preoccupations	-.044	-.032	-.046	-1.388	.166
	Lost in thoughts with others	.155	-.038	.171	4.062	.000
	Enjoyed daydreaming	-.044	-.033	-.049	-1.343	.180
	Frequent negative thoughts	.202	-.045	.241	4.472	.000
	Prefer living in the real world	-.046	-.031	-.048	-1.465	.144
	Little control over thoughts	.028	-.038	.032	.753	.452

a. Dependent Variable: Anxiety

Table 19

Dominance Analysis of Internal Questions Predicting Anxiety

	Frequentlylostinthoughts	Likequiettocontemplate	Frequentnegativepreoccupations	Frequentpositivepreoccupations	Lostinthoughtswithothers	Enjoyeddaydreaming	Frequentnegativethoughts	Preferlivinginthereralworld	Littlecontroloverthoughts
Frequently lost in thoughts	.000	1.000	.000	.805	.000	.969	.000	.852	.531
Like quiet to contemplate	.000	.000	.000	.117	.000	.594	.000	.023	.102
Frequent negative preoccupations	**1.000**	**1.000**	.000	**1.000**	**1.000**	**1.000**	**.734**	**1.000**	**1.000**
Frequent positive preoccupations	.195	.883	.000	.000	.000	.898	.000	.523	.273
Lost in thoughts with others	1.000	1.000	.000	1.000	.000	1.000	.008	1.000	.859
Enjoyed daydreaming	.031	.406	.000	.102	.000	.000	.000	.078	.164

Frequent negative thoughts	1.000	1.000	.266	1.000	.992	1.000	.000	1.000	1.000
Prefer living in the real world	.148	.977	.000	.477	.000	.922	.000	.000	.297
Little control over thoughts	.469	.898	.000	.727	.141	.836	.000	.703	.000

Note. The most dominant predictor is highlighted in bold.

Poor Sleep quality

A multiple regression was performed to predict poor sleep quality from the internal cognition questions. Table 20 shows correlations between the internal questions and poor sleep quality, a majority of the questions correlated with poor sleep quality. The multiple regression model significantly predicted poor sleep quality $F(9,628) = 27.941$, $p < .001$, adj. $R^2 = .276$, Cohen's $f^2 = 0.381$ representing a large effect size Cohen (1988). Questions "I have frequently found myself lost in my own thoughts", "I have had particular negative internal thoughts and preoccupations that I keep returning to" and "I have frequently been lost in my own thoughts which are negative/ unpleasant" added significantly to the prediction $p < .05$ the remaining six did not.

Table 20

Internal Questions Predicting Poor Sleep Quality Correlations

	Poor Sleep Quality	Frequently lost in thoughts	Like quiet to contemplate	Frequent negative preoccupations	Frequent positive preoccupations	Lost in thought with others	Enjoyed daydreaming	Frequent negative thoughts	Prefer living in the real world	Little control over thoughts
Poor Sleep Quality	1.000	.358**	-.005	.483**	-.151**	.353**	.124**	.481**	-.128**	.378**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 21

Internal Questions Predicting Poor Sleep Quality Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.550	.394		19.187	.000
	Frequently lost in thoughts	.107	-.041	.116	2.631	.009
	Like quiet to contemplate	-.037	-.029	-.047	-1.310	.191
	Frequent negative preoccupations	.176	-.038	.246	4.616	.000
	Frequent positive preoccupations	-.030	-.032	-.034	-.931	.352
	Lost in thoughts with others	.068	-.039	.082	1.748	.081
	Enjoyed daydreaming	-.049	-.033	-.060	-1.460	.145
	Frequent negative thoughts	.135	-.046	.176	2.934	.003
	Prefer living in the real world	-.011	-.032	-.013	-.347	.729
	Little control over thoughts	.027	-.038	.033	.704	.482

a. Dependent Variable: Poor Sleep Quality

Table 22

Internal Questions Predicting Poor Sleep Quality Dominance Analysis

	Frequentlylostinthoughts	Likequiettocontemplate	Frequentnegativepreoccupations	Frequentpositivepreoccupations	Lostinthoughtswithothers	Enjoyeddaydreaming	Frequentnegativethoughts	Preferlivinginthealworld	Littlecontroloverthoughts
Frequently lost in thoughts	.000	1.000	.000	1.000	1.000	1.000	.000	1.000	.750
Like quiet to contemplate	.000	.000	.000	.203	.047	.570	.000	.734	.188
Frequent negative preoccupations	**1.000**	**1.000**	.000	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
Frequent positive preoccupations	.000	.797	.000	.000	.078	.805	.000	.945	.250
Lost in thoughts with others	.000	.953	.000	.922	.000	.953	.000	1.000	.656
Enjoyed daydreaming	.000	.430	.000	.195	.047	.000	.000	.656	.227
Frequent negative thoughts	1.000	1.000	.000	1.000	1.000	1.000	.000	1.000	1.000
Prefer living in the real world	.000	.266	.000	.055	.000	.344	.000	.000	.000

Little control over thoughts	.250	.813	.000	.750	.344	.773	.000	1.000	.000

Note. The most dominant predictor is highlighted in bold.

Stress

A multiple regression was performed to predict stress from the internal cognition questions. The multiple regression model significantly predicted stress $F(9,628) = 29.420$, $p < .001$, adj. $R^2 = .286$, Cohen's $f^2 = 0.286$ representing a medium effect size Cohen (1988). Questions "I have frequently found myself lost in my own thoughts", "I have had particular negative internal thoughts and preoccupations which I keep returning to" and "I have frequently been lost in my own thoughts which are negative/unpleasant" all added significantly to the prediction, $p < .05$. Table 23 shows correlations between the internal questions and stress, a majority of the questions correlated with stress.

Table 23

Internal Questions Predicting Stress Correlations

	Stress	Frequently lost in thoughts	Like quiet to contemplate	Frequent negative preoccupations	Frequent positive preoccupations	Lost in thought with others	Enjoyed daydreaming	Frequent negative thoughts	Prefer living in the real world	Little control over thoughts
Stress	1.000	.356**	.053	.502**	-.090*	.321**	.111*	.489**	-.125**	.401**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 24

Internal Questions Predicting Stress Coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.561	.420		17.989	.000
	Frequently lost in thoughts	.120	-.043	.121	2.773	.006
	Like quiet to contemplate	.004	-.031	.004	.126	.899
	Frequent negative preoccupations	.205	-.041	.268	5.053	.000

Frequent positive preoccupations	.025	-.034	.027	.729	.466
Lost in thoughts with others	.013	-.041	.015	.324	.746
Enjoyed daydreaming	-.070	-.036	-.080	-1.956	.051
Frequent negative thoughts	.144	-.049	.175	2.948	.003
Prefer living in the real world	-.026	-.034	-.027	-.761	.447
Little control over thoughts	.079	-.041	.090	1.932	.054

a. Dependent Variable: Stress

Table 25

Internal Questions Predicting Stress Dominance Analysis

	Frequentlylostinthoughts	Likequiettocontemplate	Frequentnegativepreoccupations	Frequentpositivepreoccupations	Lostinthoughtswithothers	Enjoyeddaydreaming	Frequentnegativethoughts	Preferlivinginthereralworld	Littlecontroloverthoughts
Frequently lost in thoughts	.000	1.000	.000	1.000	1.000	1.000	.000	1.000	.625
Like quiet to contemplate	.000	.000	.000	.414	.086	.094	.000	.047	.000
Frequent negative preoccupations	**1.000**	**1.000**	.000	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
Frequent positive preoccupations	.000	.586	.000	.000	.148	.094	.000	.117	.000
Lost in thoughts with others	.000	.914	.000	.852	.000	.500	.000	.773	.000
Enjoyed daydreaming	.000	.906	.000	.906	.500	.000	.000	.719	.016
Frequent negative thoughts	1.000	1.000	.000	1.000	1.000	1.000	.000	1.000	1.000
Prefer living in the real world	.000	.953	.000	.883	.227	.281	.000	.000	.000
Little control over thoughts	.375	1.000	.000	1.000	1.000	.984	.000	1.000	.000

Note. The most dominant predictor is highlighted in bold.

Positive affect

A multiple regression was performed to predict positive affect from the internal cognition questions. Table 26 shows correlations between the internal questions and positive affect, a majority of the questions significantly correlated with positive affect. The

multiple regression model significantly predicted positive affect F (9,628) =61.592, $p < .001$, adj. $R^2 = .461$, Cohen's $f^2 = 0.855$ representing a large effect size Cohen (1988). Questions "I have had particular negative internal thoughts and preoccupations which I keep returning to", " I have had particular positive internal thoughts and preoccupations which I keep returning to", " I have frequently enjoyed daydreaming and 'playing' in my own thoughts", "I have frequently been lost in my own thoughts which are negative/unpleasant" and "I have preferred living in the real world rather than my own thoughts" all added significantly to the prediction, $p < .05$.

Table 26

Internal Questions Predicting Positive Affect Correlations

	Positive Affect	Frequently lost in thoughts	Like quiet to contemplate	Frequent negative preoccupations	Frequent positive preoccupations	Lost in thought with others	Enjoyed daydreaming	Frequent negative thoughts	Prefer living in the real world	Little control over thoughts
Positive Affect	1.000	-.320**	.059	-.562**	.385**	-.348**	-.017	-.549**	.264**	-.456**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 27

Internal Questions Predicting Positive Affect Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	6.221	.292		21.306	.000
	Frequently lost in thoughts	-.022	.030	-.027	-.723	.470
	Like quiet to contemplate	.020	.021	.030	.967	.334
	Frequent negative preoccupations	-.191	.028	-.311	-6.757	.000
	Frequent positive preoccupations	.170	.024	.229	7.177	.000
	Lost in thoughts with others	-.047	.029	-.065	-1.616	.107
	Enjoyed daydreaming	.114	.025	.162	4.582	.000
	Frequent negative thoughts	-.119	.034	-.181	-3.511	.000
	Prefer living in the real world	.116	.024	.154	4.930	.000
	Little control over thoughts	-.054	.028	-.078	-1.910	.057

a. Dependent Variable: Positive Affect

Table 28

Internal Questions Predicting Positive Affect Dominance Analysis

	Frequentlylostinthoughts	Likequiettocontemplate	Frequentnegativepreoccupations	Frequentpositivepreoccupations	Lostinthoughtswithothers	Enjoyeddaydreaming	Frequentnegativethoughts	Preferlivinginthereralworld	Littlecontroloverthoughts
Frequently lost in thoughts	.000	.500	.000	.000	.094	.148	.000	.063	.000
Like quiet to contemplate	.500	.000	.000	.000	.375	.039	.000	.000	.102
Frequent negative preoccupations	**1.000**	**1.000**	.000	**.500**	**1.000**	**.992**	**1.000**	**1.000**	**1.000**
Frequent positive preoccupations	1.000	1.000	**.500**	.000	.977	1.000	.516	1.000	.836
Lost in thoughts with others	.906	.625	.000	.023	.000	.211	.000	.125	.047
Enjoyed daydreaming	.852	.961	.008	.000	.789	.000	.242	.180	.641
Frequent negative thoughts	1.000	1.000	.000	.484	1.000	.758	.000	.688	1.000
Prefer living in the real world	.938	1.000	.000	.000	.875	.820	.313	.000	.750
Little control over thoughts	1.000	.898	.000	.164	.953	.359	.000	.250	.000

Note. The most dominant predictor is highlighted in bold.

Motivation

A multiple regression was performed to predict motivation from the internal cognition questions. The multiple regression model statistically significantly predicted motivation F (9,628) = 29.048, p < .001, adj. R^2 = .284, Cohen's f^2 = 0.428 representing a large effect size Cohen (1988). Questions "I have frequently found myself lost in my own thoughts", "I frequently like to find a quiet place/time to contemplate things", "I have had particular negative internal thoughts and preoccupations that I keep returning to", "I have had particular positive internal thoughts and preoccupations that I keep returning to" and "I have frequently enjoyed daydreaming and 'playing' in my own thoughts" all added statistically significantly to the prediction, p <.05. Table 29 shows correlations between the

internal questions and motivation, a majority of the questions significantly correlated with motivation.

Table 29

Internal Questions Predicting Motivation Correlations

	Motivation	Frequently lost in thoughts	Like quiet to contemplate	Frequent negative preoccupations	Frequent positive preoccupations	Lost in thought with others	Enjoyed daydreaming	Frequent negative thoughts	Prefer living in the real world	Little control over thoughts
Motivation	1.000	-.368**	.044	-.473**	.184**	-.355**	-.243**	-.449**	.194**	-.378**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 30

Internal Questions Predicting Motivation Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.182	.380		18.900	.000
	Frequently lost in thoughts	-.089	.039	-.099	-2.270	.024
	Like quiet to contemplate	.070	.028	.090	2.532	.012
	Frequent negative preoccupations	-.191	.037	-.276	-5.203	.000
	Frequent positive preoccupations	.073	.031	.087	2.369	.018
	Lost in thoughts with others	-.029	.037	-.036	-.766	.444
	Enjoyed daydreaming	-.084	.032	-.106	-2.600	.010
	Frequent negative thoughts	-.052	.044	-.070	-1.174	.241
	Prefer living in the real world	.044	.031	.052	1.444	.149
	Little control over thoughts	-.057	.037	-.072	-1.536	.125

a. Dependent Variable: Motivation

Table 31

Internal Questions Predicting Motivation Dominance Analysis

	Frequentlylostinthoughts	Likequiettocontemplate	Frequentnegativepreoccupations	Frequentpositivepreoccupations	Lostinthoughtswithothers	Enjoyeddaydreaming	Frequentnegativethoughts	Preferlivinginthereralworld	Littlecontroloverthoughts
Frequently lost in thoughts	.000	.805	.000	.734	1.000	.766	.500	1.000	.727
Like quiet to contemplate	.195	.000	.000	.211	.555	.344	.391	.594	.477
Frequent negative preoccupations	**1.000**	**1.000**	.000	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
Frequent positive preoccupations	.266	.789	.000	.000	.609	.461	.422	.734	.563
Lost in thoughts with others	.000	.445	.000	.391	.000	.258	.188	.516	.219
Enjoyed daydreaming	.234	.656	.000	.539	.742	.000	.438	.789	.570
Frequent negative thoughts	.500	.609	.000	.578	.813	.563	.000	.750	.672
Prefer living in the real world	.000	.406	.000	.266	.484	.211	.250	.000	.234
Little control over thoughts	.273	.523	.000	.438	.781	.430	.328	.766	.000

Note. The most dominant predictor is highlighted in bold.

Table 32 presents the summary of correlations between the nine internal cognition questions and the six well-being factors.

Table 32

Summary of Correlations Found Between Internal Questions and Well-being Factors

	Low mood/mild depression	Anxiety	Poor sleep quality	Stress	Positive affect	Motivation
Frequently lost in thoughts	.448**	.408**	.358**	.356**	-.320**	-.368**
Like quiet to contemplate	.025	.085*	-.005	.053	.059	.044
Frequent negative preoccupations	.654**	.581**	.483**	.502**	-.562**	-.473**

Frequent positive preoccupations	-.264**	-.163**	-.151**	-.090*	.385**	.184**
Lost in thoughts with others	.424**	.475**	.353**	.321**	-.348**	-.355**
Enjoyed daydreaming	.129**	.192**	.124**	.111*	-.017	-.243**
Frequent negative thoughts	.640**	.593**	.481**	.489**	-.549**	-.449**
Prefer living in the real world	-.222**	-.189**	-.128**	-.125**	.264**	.194**
Little control over thoughts	.516**	.408**	.378**	.401**	-.456**	-.378**

4.3.4 Discussion

The current study aimed to investigate the effects mind wandering has upon well-being. As we predicted in Hypothesis 2.3.1 that frequent negative and neutral internalisation would be associated with worse well-being, a positive linear relationship was found between "Frequently lost in thoughts" and low mood/mild depression, poor sleep quality and stress, and a negative relationship with motivation. Results also showed that "frequently lost in thoughts" does not predict increased anxiety or decreased positive affect which did not support our hypotheses. However, "lost in thoughts with others" did produce a positive linear relationship with anxiety, suggesting that people who spend more time lost in thoughts when with other people are more likely to have increased anxiety. Also, both of the neutral internal questions ("frequently lost in thoughts" and "lost in thoughts with others") positively correlated with low mood/mild depression, anxiety, poor sleep quality and stress, and negatively correlated with positive affect and motivation.

As expected from previous research Hoffman et al. (2016), "frequent negative thoughts" significantly predicted increased low mood/mild depression, anxiety and poor sleep quality, and decreased positive affect. Similarly, "frequent negative preoccupations" significantly predicted increased low mood/ mild depression, anxiety, poor sleep quality and

stress and decreased positive affect and motivation. This confirms Hypotheses 2.3.2 that negative internal thoughts are associated with negative well-being. “Little control over thoughts” significantly predicted increased low mood/mild depression only, suggesting that the uncontrollability characteristic of negative internal thoughts is most prevalent in depression like symptoms such as rumination. Adding to this, all of the negative internal questions had positive correlations with low mood/mild depression, anxiety, poor sleep quality and stress and negative correlations with positive affect and motivation.

Hypothesis 2.3.3 (more frequent positive thoughts will predict better well-being) was confirmed as “frequent positive preoccupations” significantly predicted increased positive affect and motivation and decreased low mood/ mild depression. There was no significant relationship between “frequent positive preoccupations” and anxiety, poor sleep quality and stress which contradicts with predictions which expected positive preoccupations to be associated with reduced anxiety and stress and better sleep quality. “Like quiet to contemplate” predicted motivation, suggesting that this active form of positive internalisation is able to increase one’s motivation.

Finally, Hypothesis 2.3.4 proposed that external focus improves well-being, this prediction was supported by “prefer living in the real world” significantly predicting increased positive affect and decreased low mood/mild depression. Suggesting that a tendency to be externally focused improves well-being. No significant linear relationship was found between “prefer living in the real world” and anxiety, poor sleep quality, stress and motivation, and therefore these findings did not support hypothesis 2.3.4. “Enjoyed daydreaming” significantly predicted reduced motivation and low mood/mild depression This demonstrates that increased daydreaming is associated with reduced well-being (consistent with hypothesis 2.3.3) and that being more externally focused increases well-being.

4.4 Relationship Between Internal Cognition Factors and Well-being

The previous section examined prediction of well-being factors on the basis of 9 individual questions probing different aspects of internalised cognition. In this section, the four factors which these 9 questions load upon were selected as predictors of well-being. It

was predicted that negative internal cognition would have a negative impact on well-being, displayed through increased low mood/mild depression, anxiety, poor sleep quality and stress and decreased positive affect and motivation. It was also predicted that positive internal and a preference for external cognition would have a positive impact on well-being, seen through decreased low mood/ mild depression, anxiety, poor sleep quality and stress and increased positive affect and motivation. It was also predicted that higher levels of neutral internal cognition would predict poorer well-being. Dominance analyses were conducted to explore which out of the four internal cognition factors is the most powerful predictor of each of the well-being factors.

4.4.1 Multiple regression analyses of internal cognition factors predicting well-being

Multiple regression analyses were performed to predict our well-being items from the four internal focus factors. Correlations between the internal cognition factors are included in order to enhance comprehension of the relationship between the variables.

This chapter's regression assumptions are displayed in Table 33 below.

Table 33

Regression Assumptions for Models Predicting Well-being Factors from Internal Cognition Factors

	Linearity	Durbin-Watson	Homoscedasticity	Multicollinearity	Studentized deleted residuals	Leverage points	Influential Points (Cook's) Distance)	Assumption of normality
Low mood/mild depression	Yes	1.789	Yes	No	No	No	No	Yes
Anxiety	Yes	2.001	Yes	No	No	No	No	Yes
Stress	Yes	1.926	Yes	No	No	No	No	Yes
Sleep quality	Yes	2.057	Yes	No	No	No	No	Yes
Positive affect	Yes	1.982	Yes	No	No	No	No	Yes
Motivation	Yes	1.922	Yes	No	No	No	No	Yes

Low Mood/ Mild depression

Inspection of Table 34 indicates that all four internal cognition factors were significantly correlated with low mood/mild depression. However, Chapter 3.2 also indicated that some of the four internal factors were correlated with each other. In such cases, multiple regression helps to assess levels of independent prediction and takes levels of shared variance into account. Thus, a multiple regression was run to predict low mood/mild depression from negative internal, neutral internal, internal/external and positive internal cognition. The multiple regression model significantly predicted low mood/mild depression $F(4,633) = 150.152$, $p < .001$, adj. R^2 0.487, Cohen's $f^2 = 0.949$ representing a large effect size Cohen (1988). Three out of the four internal focus factors added significantly to the prediction, these were negative internal ($p < .001$), positive internal ($p < .002$) neutral internal ($p < .005$). The internal/external factor did not add any significance. Dominance analysis showed negative internal cognition to be the most dominant predictor of negative internal.

Table 34

Low mood/mild depression and internal cognition factors correlations

		Low mood-Mild depression	Negative-Internal	Positive-Internal	External Cognition	Neutral-Internal
Pearson Correlation	Low mood-Mild depression	1.000	.683**	-.145*	-.219**	.495**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 35

Low mood/mild depression and internal factors coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	9.493	.454		20.914	.000
	Negative-Internal	.599	-.037	.600	16.191	.000
	Positive-Internal	-.119	-.035	-.098	-3.406	.001
	External Cognition	-.011	-.040	-.009	-.289	.772
	Neutral-Internal	.132	-.046	.115	2.886	.004

a. Dependent Variable: Low mood-Mild depression -

Table 36

Dominance Analyses of Internal Factors Predicting Low Mood/Mild Depression.

	Negative internal	Positive internal	External Cognition	Neutral internal
Negative internal	.000	**1.000**	**1.000**	**1.000**
Positive internal	.000	.000	.750	.500
External Cognition	.000	.250	.000	.000
Neutral internal	.000	.500	1.000	.000

Note. The most dominant predictor is highlighted in bold.

Anxiety

Table 37 presents the correlations between the internal factors and anxiety, negative internal, external cognition and neutral internal all significantly correlated with anxiety. A multiple regression was performed to predict anxiety from the internal factors. The model statistically predicted anxiety, $F(4,633) = 106.866$, $p < .001$, adj. $R^2 = .399$, Cohen's $f^2 = 0.675$ representing a large effect size (Cohen, 1988). Only the negative and neutral internal factors added statistically significantly to the prediction, $p < .001$. Dominance analysis showed negative internal cognition to be the most dominant predictor of negative internal.

Table 37

Anxiety and internal focus factors correlations

		Anxiety	Negative-Internal	Positive-Internal	External Cognition	Neutral-Internal
Pearson Correlation	Anxiety	1.000	.617**	-.044	-.240**	.504**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 38

Anxiety and internal focus factors coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	10.214	.461		22.133	.000
	Negative-Internal	.468	-.038	.495	12.433	.000
	Positive-Internal	-.010	-.036	-.009	-.286	.775

External Cognition	-.024	-.040	-.020	-.589	.556
Neutral-Internal	.199	-.047	.183	4.268	.000

a. Dependent Variable: Anxiety

Table 39

Dominance Analyses of Internal Factors Predicting Anxiety

	Negative internal	Positive internal	External Cognition	Neutral internal
Negative internal	.000	**1.000**	**1.000**	**1.000**
Positive internal	.000	.000	.250	.000
External Cognition	.000	.750	.000	.000
Neutral internal	.000	1.000	1.000	.000

Note. The most dominant predictor is highlighted in bold.

Poor sleep quality

Correlations between the internal questions and poor sleep quality are presented in Table 40, significant correlations were found for all four of the internal factors. A multiple regression was performed to predict sleep quality from the internal factors. The multiple regression model significantly predicted poor sleep quality, $F(4,633) = 59.958$, $p < .001$, adj. $R^2 = .270$, Cohen's $f^2 = 0.379$ representing a large effect size (Cohen, 1988). Only the negative and neutral internal factors added statistically significantly to the prediction, $p < .001$ and $p < .002$ respectively. Dominance analysis showed negative internal cognition to be the most dominant predictor of negative internal.

Table 40

Poor sleep quality and internal focus factors correlations

		Poor Sleep Quality	Negative-Internal	Positive-Internal	External Cognition	Neutral-Internal
Pearson Correlation	Poor Sleep Quality	1.000	.506**	-.095*	-.159**	.405**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 41

Poor sleep quality and Internal focus factors coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.966	.466		17.100	.000
	Negative-Internal	.350	-.038	.405	9.215	.000
	Positive-Internal	-.066	-.036	-.063	-1.845	.066
	External Cognition	.023	-.041	.021	.561	.575
	Neutral-Internal	.160	-.047	.161	3.400	.001

a. Dependent Variable: Poor Sleep Quality

Table 42

Dominance Analyses of Internal Factors Predicting Poor Sleep Quality

	Negative internal	Positive internal	External Cognition	Neutral internal
Negative internal	.000	**1.000**	**1.000**	**1.000**
Positive internal	.000	.000	.750	.000
External Cognition	.000	.250	.000	.000
Neutral internal	.000	1.000	1.000	.000

Note. The most dominant predictor is highlighted in bold.

Stress

Table 43 displays the correlations found between the internal cognition factors and stress, negative internal, external cognition and neutral internal all significantly correlated with stress positive internal did not. Another multiple regression model statistically predicted stress, $F(4,633) = 62.726$, $p < .001$, adj. $R^2 = .279$, Cohen's $f^2 = 0.387$ representing a large effect size Cohen (1988) . Again, only the negative and neutral internal factors added statistically significantly to the prediction, $p < .001$ and $p < .05$ respectively. Dominance analysis showed negative internal cognition to be the most dominant predictor of negative internal.

Table 43

Stress and internal factors correlations

	Stress	Negative-Internal	Positive-Internal	External Cognition	Neutral-Internal
Pearson Correlation Stress	1.000	.526**	-.021	-.149**	.385**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 44

Stress and Internal focus factors coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	8.031	.498		16.141	.000
	Negative-Internal	.439	-.041	.472	10.824	.000
	Positive-Internal	.020	-.038	.018	.522	.602
	External Cognition	.031	-.043	.027	.709	.479
	Neutral-Internal	.106	-.050	.099	2.099	.036

a. Dependent Variable: Stress

Table 45

Dominance Analyses of Internal Factors Predicting Stress

	Negative internal	Positive internal	External Cognition	Neutral internal
Negative internal	.000	**1.000**	**1.000**	**1.000**
Positive internal	.000	.000	.250	.000
External Cognition	.000	.750	.000	.000
Neutral internal	.000	1.000	1.000	.000

Note. The most dominant predictor is highlighted in bold.

Positive Affect

Correlations between the internal cognition factors and positive affect are displayed in Table 46, all four of the internal cognition factors significantly correlated with positive affect. A multiple regression model also statistically predicted positive affect, F (4,633) = 107.433, $p < .001$, adj. $R^2 = .401$, Cohen's $f^2 = 0.669$ representing a large effect size Cohen (1988) . In contrast to the factors more associated with poor well-being, negative and positive internal focus added statistically significantly to the prediction, $p < .001$. However, external focus and neutral internal did not predict positive affect. Dominance analysis showed negative internal cognition to be the most dominant predictor of positive affect.

Table 46

Positive affect and Internal focus factors correlations

		Positive Affect	Negative-Internal	Positive-Internal	External Cognition	Neutral-Internal
Pearson Correlation	Positive Affect	1.000	-.594**	.272**	.170**	-.380**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 47

Positive affect and Internal factors coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.247	.363		19.975	.000
	Negative-Internal	-.409	.030	-.551	-13.809	.000
	Positive-Internal	.207	.028	.229	7.393	.000
	External Cognition	.023	.032	.025	.719	.473
	Neutral-Internal	-.023	.037	-.027	-.622	.534

a. Dependent Variable: Positive Affect

Table 48

Dominance Analyses of Internal Factors Predicting Positive Affect

	Negative internal	Positive internal	External Cognition	Neutral internal
Negative internal	.000	**1.000**	**1.000**	**1.000**
Positive internal	.000	.000	1.000	.500
External Cognition	.000	.000	.000	.500
Neutral internal	.000	.500	.500	.000

Note. The most dominant predictor is highlighted in bold.

Motivation

Correlations are presented in Table 49 below, all four of the internal cognition factors significantly correlate with motivation. A multiple regression model also statistically predicted increased motivation, F (4,633) = 62.919, p < .001, adj. R^2 = .280, Cohen's f^2 = 0.389 representing a large effect size Cohen (1988). Interestingly, all four of the internal focus variables added statistically significantly to the prediction of increased motivation,

(negative and neutral $p < .001$; external cognition $p < .002$; neutral internal $p < .05$). Dominance analysis showed negative internal cognition to be the most dominant predictor of negative internal.

Table 49

Motivation and Internal Factors Correlations

		Motivation	Negative-Internal	Positive-Internal	External Cognition	Neutral-Internal
Pearson Correlation	Motivation	1.000	-.493**	.141**	.274**	-.410**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 50

Motivation and Internal focus factors Coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	6.292	.449		14.018	.000
	Negative-Internal	-.312	.037	-.372	-8.514	.000
	Positive-Internal	.125	.035	.123	3.614	.000
	External Cognition	.131	.039	.127	3.343	.001
	Neutral-Internal	-.115	.045	-.119	-2.526	.012

a. Dependent Variable: Motivation

Table 51

Dominance Analyses of Internal Factors Predicting Motivation

	Negative internal	Positive internal	External Cognition	Neutral internal
Negative internal	.000	**1.000**	**1.000**	**1.000**
Positive internal	.000	.000	.500	.250
External Cognition	.000	.500	.000	.500
Neutral internal	.000	.750	.500	.000

Note. The most dominant predictor is highlighted in bold.

Table 52 below summarises the correlations found during this section, detailing whether a significant correlation was found between the four internal factors and each of the six well-being factors. Table 53 summarises significant regressions between internal cognition factors and the six well-being factors.

Table 52

Summary of Correlations Found Between Internal Cognition Factors and Well-being Factors

	Low mood/Mild depression	Anxiety	Poor Sleep Quality	Stress	Positive Affect	Motivation
Negative Internal	.683**	.617**	.506**	.526**	-.594**	-.493**
Positive Internal	-.145*	-.044	-.095*	-.021	.272**	.141**
External Cognition	-.219**	-.240**	-.159**	-.149**	.170**	.274**
Neutral Internal	.495**	.504**	.405**	.385**	-.380**	-.410**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 53

Summary of Internal Cognition Factors Which Significantly Predicted Well-being Factors

	Low mood/Mild depression	Anxiety	Poor Sleep Quality	Stress	Positive Affect	Motivation
Negative Internal	Yes	Yes	Yes	Yes	Yes	Yes
Positive Internal	Yes	No	No	No	Yes	Yes
External Cognition	No	No	No	No	No	Yes
Neutral Internal	Yes	Yes	Yes	Yes	No	Yes

Note. Yes - a significant predictor, no - not a significant predictor

4.4.2 Discussion

This section examined the relationship between the four internal cognition factors and the six well-being factors. We proposed that negative mind wandering would be associated with increased poor well-being. This was supported by the finding that negative internal significantly predicted increased low mood/mild depression, anxiety, poor sleep quality and stress, and decreased positive affect and motivation. It should be noted that in regressions demonstrating these relationships, the overall effect sizes were large and the sample size was well beyond requirements for reliable regression (Kelley & Maxwell, 2003). As such these are non-trivial findings. Moreover, in dominance analyses, negative internal was always the most powerful predictor of all six well-being factors and according to Darlington and Hayes (2016) dominance analysis provides a useful measure of relative effect size. While the impact of negative internal cognition upon well-being is unsurprising, this study demonstrates that cross-sectional measures of levels of self-reported negative cognition are a very powerful predictor of well-being. In addition, the findings also indicate that lower motivation levels are associated with a tendency for negative thoughts.

Confirming Hypothesis 2.3.1 which predicted that negative and neutral internalisation would be associated with poor well-being, the neutral internal factor predicted increased low mood/mild depression, anxiety, poor sleep quality and stress and decreased motivation, but no linear relationship was found between neutral internal and positive affect. One concern associated with the neutral internal factor was that the two questions loading upon it might attract agreement from participants experiencing frequent negative internal thoughts. For example, the question, “I have frequently found myself lost in my own thoughts” might attract greater agreement from an individual who is frequently experiencing negative internal thoughts. This concern is supported by results reported in Chapter 3.2 which indicated a significant positive correlation between negative internal and neutral internal ($r=0.632$, $p< .001$). If this concern were correct, then this leads to the prediction that the internal cognition factor would be eliminated as a predictor in multiple regression. Given that this was not always the case suggests that this factor does probe independent elements of internal cognition which go beyond negative thoughts and the most parsimonious interpretation is that it provides additional information about a general tendency towards non-valenced internalised cognition. In turn, this interpretation is

consistent with Killingsworth and Gilbert (2010) who reported that neutral mind wandering was associated with poorer well-being than externally focused cognition. Although that study cited the dependent variable as "happiness" the actual question they asked was "How are you feeling right now" on a scale from "very bad" to "very good." Because this question is imprecise, our findings provide a more detailed understanding (albeit in a cross-sectional study). Our data indicate that while neutral internal cognition predicted higher levels of stress, anxiety, poor sleep quality and depression, it did not predict positive affect. This supports Killingsworth and Gilbert's declaration that internalised cognition is not conducive to happiness when they state, "In conclusion, a human mind is a wandering mind, and a wandering mind is an *unhappy* mind" (P. 932, italics added for emphasis). However, our regression findings suggest that neutral thought does not predict happiness or unhappiness (based on our positive affect factor which includes statements such as "I have frequently felt happy"). However, it does predict increased levels of anxiety, depression, stress and poor sleep quality. In making this argument, it is important to note that prior to regression, a significant correlation between neutral internal and positive affect was observed (r=0.38) despite subsequent elimination of neutral internal in a regression predicting positive affect. Though tentative, the significant correlation between neutral internal and negative internal (r=0.632, Cohen's $f^2 = 0.66$ - a large effect size) may reflect the fact that participants with higher levels of negative internal cognition did have a tendency to affirm questions within the neutral cognition factor but this shared variance eliminated a capacity to predict positive affect. However, for predicting negative aspects of well-being (e.g. stress or anxiety) there was sufficient unshared variance for negative internal and neutral internal to emerge as independent predictors.

Findings for neutral internal also cast some doubt upon one alternative interpretation of Killingsworth and Gilbert. According to Poerio, Totterdell & Miles (2013), levels of prior sadness predicted a greater tendency for subsequent increased internal cognition. This was revealed in a study which sampled participants mood and cognitive focus at a higher sampling rate. The authors therefore concluded that poorer well-being during mind wandering is an artefact of the fact that internal cognition is more likely to occur after prior evoked experiences leading to poorer well-being. Indeed, their study showed that earlier bouts of anxiety or sadness led to subsequent internal cognition that

was coloured by anxiety and sadness respectively. However, while elements of this hypothesis may be correct, results of the current study suggest a tendency towards neutral cognition is associated with poorer well-being. This interpretation is based upon the fact that neutral internal was not eliminated in a regression analysis involving negative internal as a co-predictor.

Confirming Hypothesis 2.3.3 that positive thoughts will predict positive well-being, higher levels of positive internal significantly predicted increased positive affect, higher motivation and decreased low mood/ mild depression. No relationship was found between positive internal and anxiety, poor sleep quality and stress. The fact that higher levels of positive internal cognition predict higher positive affect may seem intuitively obvious. However, it is worth noting that Killingsworth and Gilbert (2010) reported that positive mind wandering led to no greater 'happiness' than focus upon the external world. In our cross-sectional study, results indicate that positive mind wandering does predict positive affect. The fact that positive mind wandering predicts higher levels of motivation is consistent with Kringelbach and Berridge (2010) who argued that elements of positive affect are connected to mesolimbic dopaminergic systems which support motivation. Indeed, they argue that enhanced states of motivation, for example when caused by deep brain stimulation of mesolimbic regions, are experienced as intrinsically positive. An interesting feature of current results is that they demonstrate that both positive and negative mind wandering predict motivation. It is well known that motivation is compromised when well-being is poor (Nolen-Hoeksema, 1991) but current findings indicate that positive affect is an independent predictor of motivation. Interestingly, while higher levels of positive mind wandering predicted lower levels of depression, they did not predict levels of anxiety or stress. This suggests that positive mind wandering might be an especially useful intervention in the treatment of depression, but less so for anxiety and stress

Finally, we were unable to support Hypothesis 2.3.4 that a preference for external focus predicts better well-being as no significant relationship was found between the external cognition factor and low mood/ mild depression, anxiety, poor sleep quality, stress or positive affect. This is a problematic finding because it suggests that a preference for the external world over the internal world does not influence major elements of mood and well-being. This factor is made more complex because it contains two questions, first "I have

preferred living in the real world rather than my own thoughts," and second I have frequently enjoyed daydreaming and 'playing' in my own thoughts." The problem is that elements of the second question are suggestive of positive internal cognition. Nevertheless, this factor had a reasonably high level of internal consistency (Cronbach's alpha =0.71). However, a preference for external cognition did predict motivation and this is consistent with the hypothesis that many motivated activities are contingent upon interaction with the external world. The fact that this relationship was demonstrated indicates that the external cognition factor is not a completely 'silent' variable and its relationship with motivation provides some level of construct validity. One possibility is a potential ambiguity in the question, "I have preferred living in the real world rather than in my own thoughts." A person answering this question could experience high levels of internal cognition and would 'prefer' to live in the "real world" even though for them this is not actually the case. In future studies we would recommend adding further explicitly worded external cognition questions in order to ensure there is confusion in what the factor is probing. For example, "Over the last six weeks I have spent more time living in the "real world" rather than in my own thoughts."

4.5 The Relationship between Well-being and Internal Cognition

In this section multiple regression analyses were conducted in order to assess the extent to which the six well-being factors predict each of the internal cognition factors. This is the opposite direction of prediction from the previous chapters in which well-being factors were the predicted dependent variable. This analysis provides an opportunity to look at the conjoint predictive contributions of well-being factors and also to assess how many retain a significant prediction within regression analyses. These analyses provide a qualitatively different perspective to findings reported in the previous section because the regression models pool qualitatively different levels of shared variance.

4.5.1 Multiple regression analyses of well-being factors predicting internal cognition factors

Multiple regression analyses were performed to predict our four internal cognition factors from our six well-being items. Correlations between the well-being factors are

included in order to enhance comprehension of the relationship between the variables. Dominance analyses were conducted to address which well-being item was the most powerful predictor of each internal cognition factor. Regression assumptions are displayed in Table 54 below.

Table 54

Multiple Regression Assumption Tests for Models Predicting Internal Factors from Well-being Factors

	Linearity	Durbin-Watson	Homoscedasticity	Multicollinearity	Studentized deleted residuals	Leverage points	Influential Points (Cook's Distance)	Assumption of normality
Negative internal	Yes	1.849	Yes	No	No	No	No	Yes
Positive internal	Yes	2.163	Yes	No	No	No	No	Yes
Internal/ External	Yes	1.976	Yes	No	No	No	No	Yes
Neutral internal	Yes	2.100	Yes	No	No	No	No	Yes

Negative internal

Table 55 displays the correlations between negative internal cognition and the six well-being factors, all six of the well-being factors significantly correlate with negative internal cognition. A multiple regression model was run in order to predict negative internal focus from our well-being factors. This approach enables an appreciation of the conjoint influence of well-being factors, previously considered independently upon the internal cognition factors. The multiple regression model statistically significantly predicted negative internal focus, $F(6, 631) = 123.635$, $p < .0005$, adj. $R^2 = .536$, Cohen's $f^2 = 1.155$ representing a large effect size Cohen (1988). Low mood, anxiety, motivation added significantly to the prediction ($p < .001$) as did poor sleep quality ($p < .05$). Stress and positive affect did not add significantly to the prediction. Dominance analysis showed low mood/mild depression to be the most dominant predictor of negative internal.

Table 55

Negative internal focus and well-being factors correlations

		Negative-Internal	Low mood-Mild depression	Anxiety	Poor Sleep Quality	Stress	Positive Affect	Motivation
Pearson Correlation	Negative-Internal	1.000	.687**	.617**	.509**	.528**	-.594**	-.493**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 56

Negative internal focus and well-being factors coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	11.026	-.265		41.572	.000
	Low mood-Mild depression	.348	-.052	.348	6.657	.000
	Anxiety	.219	-.042	.207	5.231	.000
	Poor sleep Quality	.103	-.041	.089	2.496	.013
	Stress	.041	-.041	.038	.991	.322
	Positive Affect	-.099	.060	-.074	-1.656	.098
	Motivation	-.155	.039	-.130	-3.967	.000

a. Dependent Variable: Negative-Internal

Table 57

Dominance Analyses of Well-being Factors Predicting Negative Internal

	Low mood/mild depression	Anxiety	Poor sleep Quality	Stress	Positive Affect	Motivation
Low mood/mild depression	.000	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
Anxiety	.000	.000	1.000	1.000	1.000	1.000
Sleep quality	.000	.000	.000	.625	.500	.125
Stress	.000	.000	.375	.000	.188	.250
Positive Affect	.000	.000	.500	.813	.000	.500
Motivation	.000	.000	.875	.750	.500	.000

Note. The most dominant predictor is highlighted in bold.

Positive internal

Correlations between positive internal cognition and the six well-being factors are displayed in Table 58; low mood/mild depression, poor sleep quality, positive affect and motivation all significantly correlated with positive internal, anxiety and stress did not. A multiple regression model predicted positive internal focus from our selected well-being factors, the multiple regression model significantly predicted positive internal focus, $F(6,631) = 12.545$, $p < .001$, adj. $R^2 = .098$, Cohen's $f^2 = 0.109$ representing a small effect size Cohen (1988). Positive affect ($p < .001$), stress and anxiety (both $p < .05$) all added statistically significantly to the prediction, low mood/mild depression, motivation and sleep quality did not. Dominance analysis showed positive affect to be the most dominant predictor of negative internal.

Table 58

Positive internal focus and well-being factors correlations

		Positive-Internal	Low mood-Mild depression	Anxiety	Poor sleep Quality	Stress	Positive Affect	Motivation
Pearson Correlation	Positive-Internal	1.000	-.144**	-.043	-.094*	-.020	.272**	.141**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 59

Positive internal focus and well-being factors coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.765	.304		12.397	.000

Low mood-Mild depression	-.053	-.060	.064	-.882	.378
Anxiety	-.101	-.048	.116	-2.097	.036
Poor Sleep Quality	.018	-.047	-.019	.385	.700
Stress	-.108	-.047	.122	-2.283	.023
Positive Affect	.456	.069	.412	6.642	.000
Motivation	.064	.045	.065	1.417	.157

a. Dependent Variable: Positive Internal

Table 60

Dominance Analyses of Well-being Factors Predicting Positive Internal

	Low mood/mild depression	Anxiety	Poor Sleep Quality	Stress	Positive Affect	Motivation
Low mood/mild depression	.000	.500	1.000	.500	.000	.875
Anxiety	.500	.000	.688	.063	.000	.563
Poor Sleep quality	.000	.313	.000	.188	.000	.063
Stress	.500	.938	.813	.000	.000	.688
Positive Affect	**1.000**	**1.000**	**1.000**	**1.000**	.000	**1.000**
Motivation	.125	.438	.938	.313	.000	.000

Note. The most dominant predictor is highlighted in bold.

External Cognition

Correlations between external cognition and the six well-being factors are presented in Table 61 below, all six well-being factors significantly correlated with external cognition. A multiple regression was then run predicting external focus from our well-being factors. The multiple regression model statistically significantly predicted external focus, F (6,631) = 11.057, $p < .001$, adj. $R^2 = .087$ Cohen's $f^2 = 0.095$ representing a small effect size Cohen (1988). Out of the well-being factors only anxiety and motivation added significantly to the prediction, $p < .05$ and $p < .001$ respectively, low mood/ mild depression, positive affect, sleep quality and stress did not. Dominance analysis showed motivation to be the most dominant predictor of negative internal.

Table 61

External Cognition and well-being factors correlations

		External Cognition	Low mood-Mild depression	Anxiety	Poor Sleep Quality	Stress	Positive Affect	Motivation
Pearson Correlation	External Cognition	1.000	-.218**	-.239**	-.158**	-.148**	.170**	.274**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 62

External cognition and well-being factors coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.805	.303		12.556	.000
	Low mood-Mild depression	-.071	-.060	-.088	-1.195	.232
	Anxiety	-.130	-.048	-.151	-2.716	.007
	Poor Sleep Quality	.018	-.047	.019	.376	.707
	Stress	.038	-.047	.043	.806	.421
	Positive Affect	-.062	.069	-.056	-.898	.369
	Motivation	.208	.045	.215	4.657	.000

a. Dependent Variable: External cognition

Table 63

Dominance Analyses of Well-being Factors Predicting External Cognition

	Low mood/mild depression	Anxiety	Sleep Quality	Stress	Positive Affect	Motivation
Low mood/mild depression	.000	.000	.938	.938	.938	.000
Anxiety	1.000	.000	1.000	1.000	1.000	.000
Sleep quality	.063	.000	.000	.375	.375	.000

Stress	.063	.000	.625	.000	.375	.000
Positive Affect	.063	.000	.625	.625	.000	.000
Motivation	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	.000

Note. The most dominant predictor is highlighted in bold.

Neutral internal

Correlations between neutral internal and the six well-being items are displayed in Table 64, all six of the well-being factors significantly correlated with neutral internal cognition. A multiple regression model was run to predict neutral internal focus from the well-being factors. The multiple regression model statistically significantly predicted Neutral internal focus, $F(6,631) = 51.070$, $p < 0.005$, adj. $R^2 = .320$, Cohen's $f^2 = 0.320$ representing a medium effect size Cohen (1988). Similar to Negative internal focus, low mood, anxiety, motivation added significantly to the prediction, $p < 0.01$, as did poor sleep quality $p < .05$. Whereas positive affect and stress did not. Dominance analysis showed anxiety to be the most dominant predictor of negative internal.

Table 64

Neutral internal focus and well-being factors correlations

		Neutral-Internal	Low mood-Mild depression	Anxiety	Poor Sleep Quality	Stress	Positive Affect	Motivation
Pearson Correlation	Neutral-Internal	1.000	.494**	.504**	.404**	.383**	-.380**	-.410**

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed)

Table 65

Neutral internal focus and well-being factors coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.

1	(Constant)	10.176	.279		36.481	.000
	Low mood-Mild depression	.234	-.055	.268	4.243	.000
	Anxiety	.236	-.044	.256	5.344	.000
	Poor Sleep Quality	.102	-.044	.101	2.337	.020
	Stress	-.011	-.043	-.011	-.245	.807
	Positive Affect	.120	.063	.102	1.896	.058
	Motivation	-.171	.041	-.165	-4.143	.000

a. Dependent Variable: Neutral-Internal

Table 66

Dominance Analyses of Well-being Factors Predicting Neutral Internal

	Low mood/mild depression	Anxiety	Sleep Quality	Stress	Positive Affect	Motivation
Low mood/mild depression	.000	.000	1.000	1.000	1.000	.750
Anxiety	**1.000**	.000	**1.000**	**1.000**	**1.000**	**1.000**
Sleep quality	.000	.000	.000	.938	1.000	.000
Stress	.000	.000	.063	.000	.438	.000
Positive Affect	.000	.000	.000	.563	.000	.000
Motivation	.250	.000	1.000	1.000	1.000	.000

Table 67 below summarises significant regressions between internal cognition factors and the six well-being factors found in this section.

Table 67

Summary of Significant Regressions Found Between Well-being Factors Predicting Internal Cognition Factors

	Negative Internal	Positive Internal	External Cognition	Neutral Internal
Low mood/Mild depression	Yes	No	No	Yes
Anxiety	Yes	Yes	Yes	Yes
Poor Sleep Quality	Yes	No	No	Yes
Stress	No	Yes	No	No

Positive Affect	No	Yes	No	No
Motivation	Yes	No	Yes	Yes

Note. Yes – a significant predictor, No – not a significant predictor

4.5.2 Discussion

This Chapter explored how the six selected well-being items predicted internal cognition. The critical issue here was the extent to which of the six well-being factors were able to independently predict each of the four internal focus factors.

Negative internal cognition was predicted by lower mood/mild depression, higher anxiety, and poor sleep quality. Moreover, lower levels of motivation also predicted increased levels of negative internal cognition. The important finding here is that these predictors indicate an independent capacity to predict suggesting multiple potential contributions to negative rumination (with the caveat that directions of causality cannot be specified with reliability).

Increased positive internal cognition was associated with significantly lower anxiety and stress and was also associated with increased positive affect. Interestingly, levels of depression did not predict levels of positive internal cognition within the regression model. It is also interesting that the effect size for predicting positive internal cognition from the well-being variables was relatively small (Cohen's $f^2 = 0.109$) and correlations between positive internal cognition and well-being factors were all quite small.

External cognition was predicted by lower anxiety and increased motivation. This finding is interesting as external cognition did not predict reduced anxiety in the previous section, suggesting an independent effect of reduced anxiety upon increased external focus. Further, the effect size for predicting external cognition from the well-being items was small (Cohen's $f^2 = 0.095$).

Neutral mind wandering, as expected, was associated with significantly increased low mood/mild depression, anxiety and poor sleep quality, as well as decreased motivation. In contrast to our predictions increased stress did not predict increased mind wandering and neutral internal cognition did not significantly reduce positive affect. Incorporating

significant findings from the previous section, overall results illustrate that poor well-being is intrinsically tied to frequent mind wandering.

4.6 Mediating effects of well-being factors

In this section separate mediation analyses were performed with negative and neutral internal cognition predicting the well-being factors most associated with poor well-being (low mood/mild depression, anxiety, poor sleep quality and stress). An iterative series of mediations were performed where relationships between mind wandering and each well-being factor were examined separately, but with the other three well-being factors included as mediators. For example, predicting depression on the basis of negative mind wandering with stress, sleep quality and anxiety as mediators. As noted earlier, these analyses provide avenues for exploring potential "pathways of influence" (Darlington and Hayes, 2016). It is acknowledged that these analyses are exploratory. However, findings may motivate future research and our large sample size also enhances confidence that further research might be profitable.

The four selected well-being items were chosen because previous literature has demonstrated that they all demonstrate consistently strong relationships with one another

4.6.1 Negative internal cognition predicting well-being factors

A significant direct effect was found between negative internal and low mood/ mild depression, and significant indirect effects were found for anxiety and stress, no indirect effect was found for sleep quality (Figure 11).

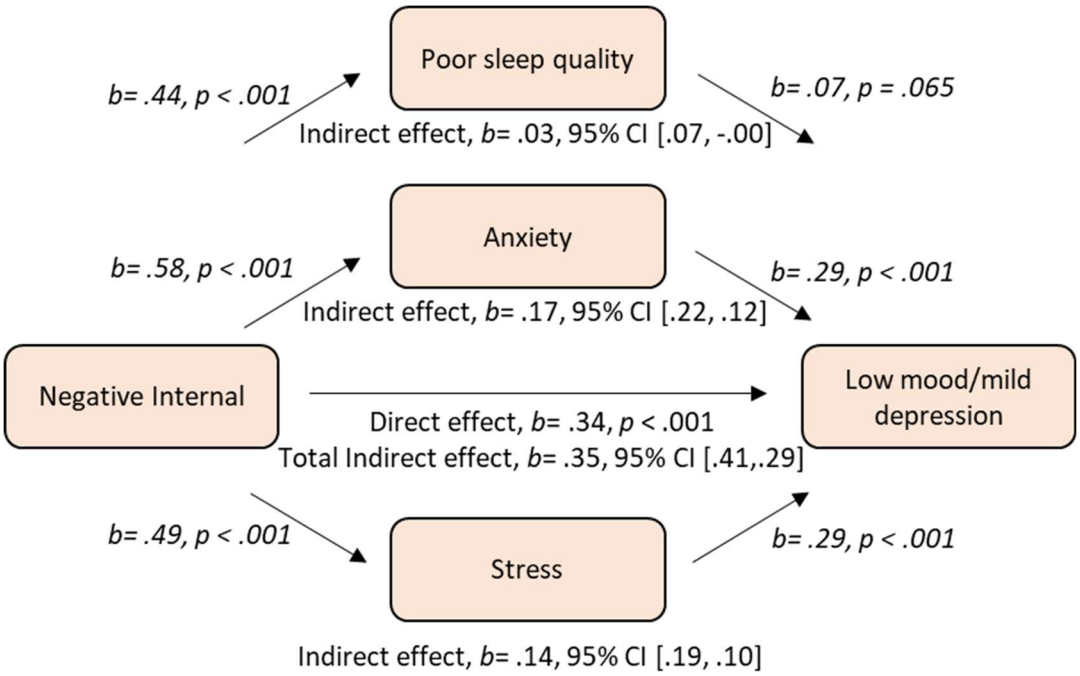

Figure 11. Mediation model of Negative Internal as a predictor of Low mood/mild depression, mediated by Anxiety, Poor sleep quality and Stress. The confidence interval for the indirect effect is a BCa bootstrapped CI based on 5000 samples

A significant direct effect was found between negative internal and anxiety, and significant indirect effects were found for low mood/ mild depression, poor sleep quality and stress (Figure 12).

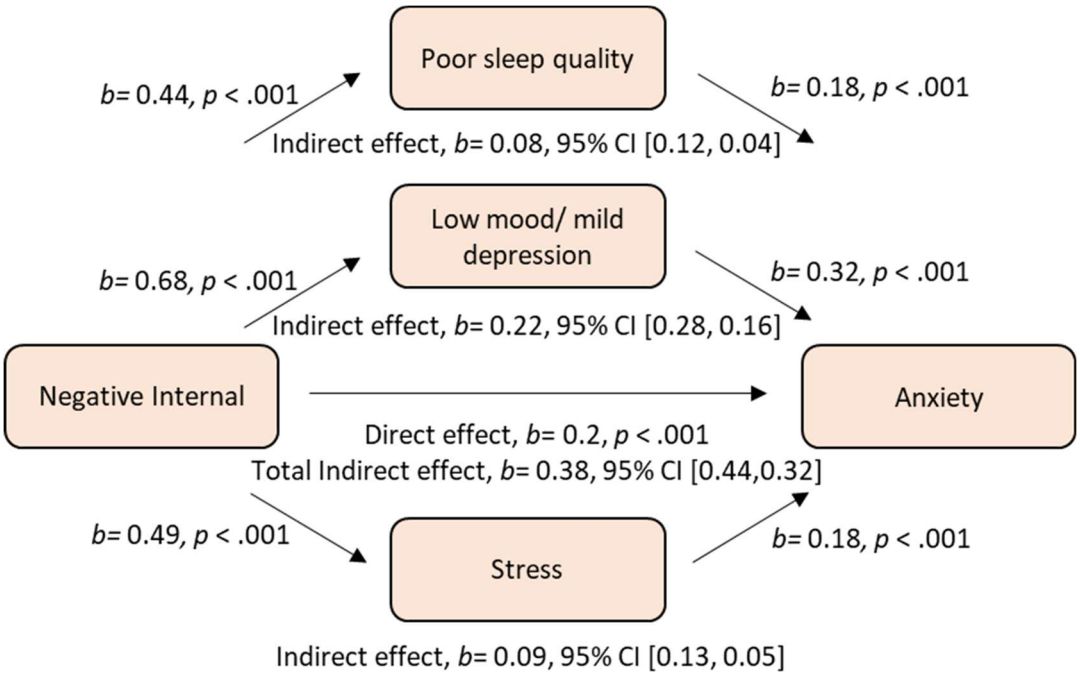

Figure 12. Mediation model of Negative Internal as a predictor of Anxiety, mediated by Low mood/mild depression, Poor sleep quality and Stress. The confidence interval for the indirect effect is a BCa bootstrapped CI based on 5000 samples

A significant direct effect was found between negative internal and poor sleep quality, and significant indirect effects were found for anxiety and stress. However, no indirect effect was found for low mood/mild depression (Figure 13).

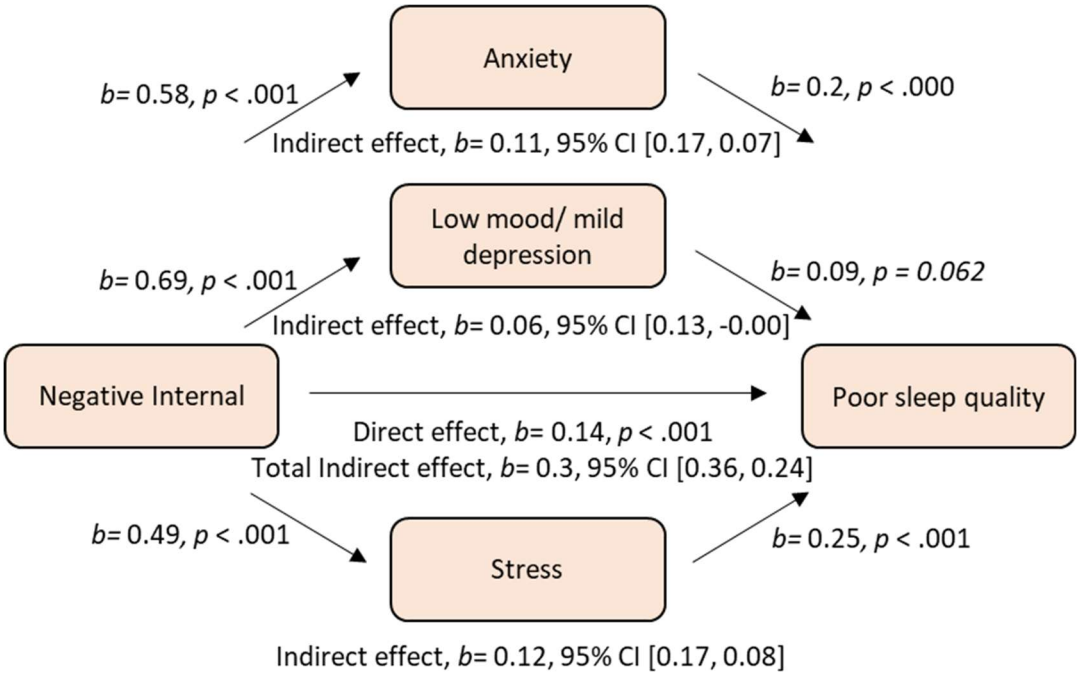

Figure 13. Mediation model of Negative Internal as a predictor of Poor sleep quality, mediated by Low mood/mild depression, Anxiety and Stress. The confidence interval for the indirect effect is a BCa bootstrapped CI based on 5000 samples

No direct effect was found between negative internal and stress. However, indirect effects were found for low mood/mild depression, anxiety and sleep quality (Figure 14). This analysis reveals a complete mediation, with the direct effect eliminated by the mediators.

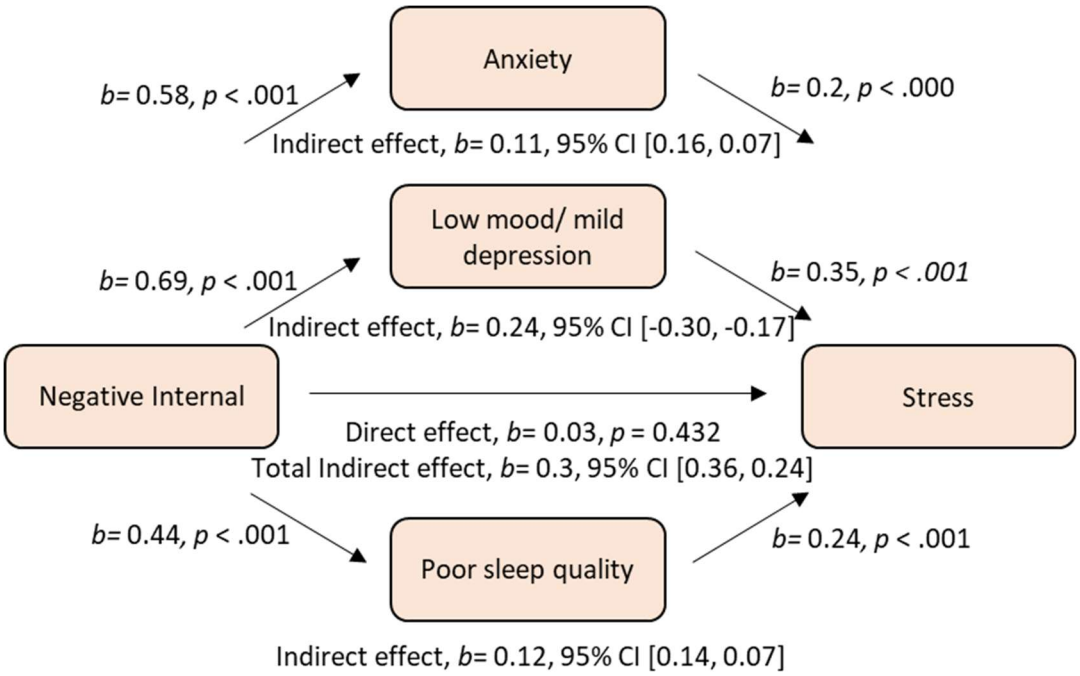

Figure 14. Mediation model of Negative Internal as a predictor of Stress, mediated by Low mood/mild depression, Anxiety and Poor sleep quality. The confidence interval for the indirect effect is a BCa bootstrapped CI based on 5000 samples

4.6.2 Neutral internal cognition predicting well-being factors

A direct effect was found between neutral internal and low mood/ mild depression, and significant indirect effects were found for anxiety, poor sleep quality and stress (Figure 15). This represents a partial mediation outcome.

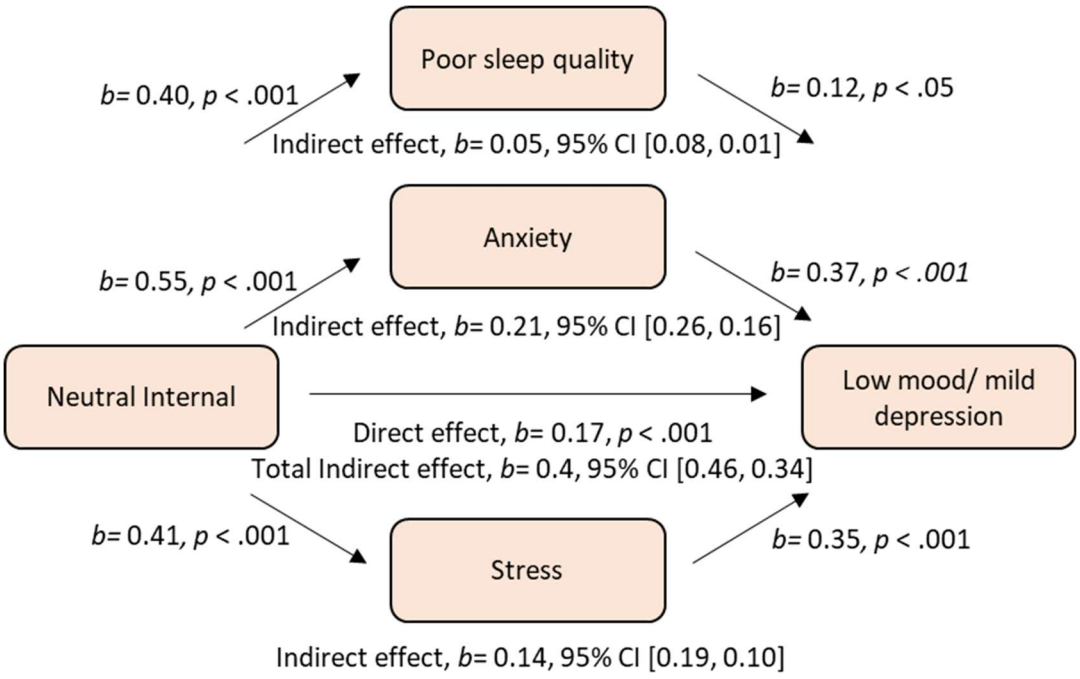

Figure 15. Mediation model of Neutral Internal as a predictor of Low mood/mild depression, mediated by Anxiety, Poor sleep quality and Stress. The confidence interval for the indirect effect is a BCa bootstrapped CI based on 5000 samples

A direct effect was found between neutral internal and anxiety, and indirect effects were found for low mood/ mild depression, poor sleep quality and stress (Figure 16).

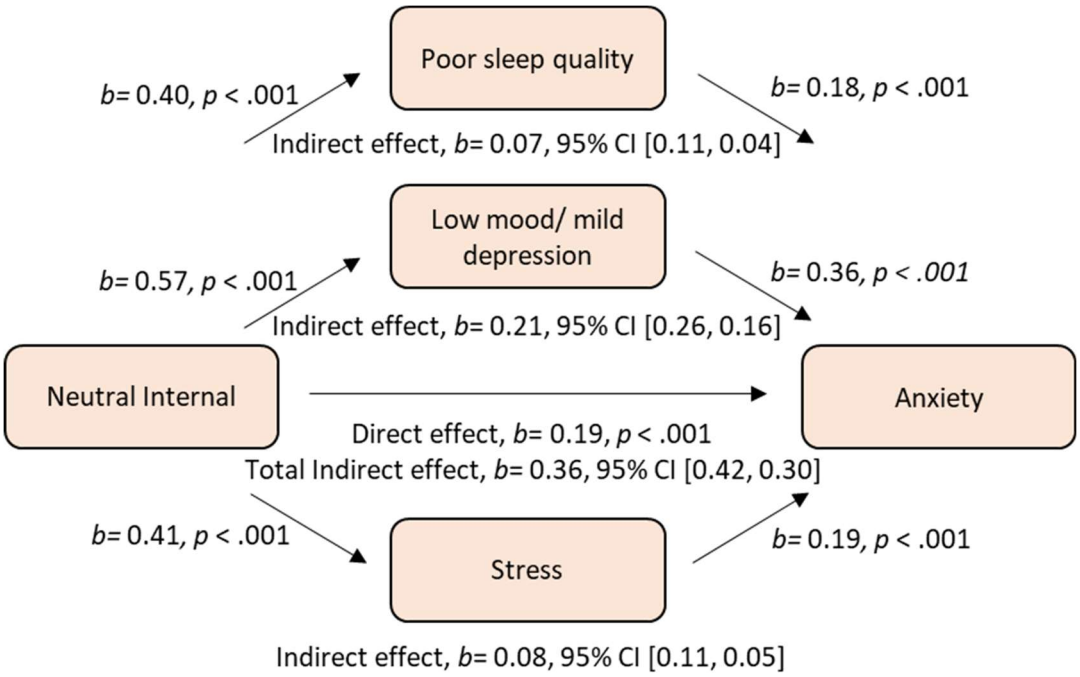

Figure 16. Mediation model of Neutral Internal as a predictor of Anxiety, mediated by Low mood/mild depression, Poor sleep quality and Stress. The confidence interval for the indirect effect is a BCa bootstrapped CI based on 5000 samples

A direct effect was found between neutral internal and poor sleep quality, and indirect effects were found for low mood/ mild depression, anxiety and stress (Figure 17).

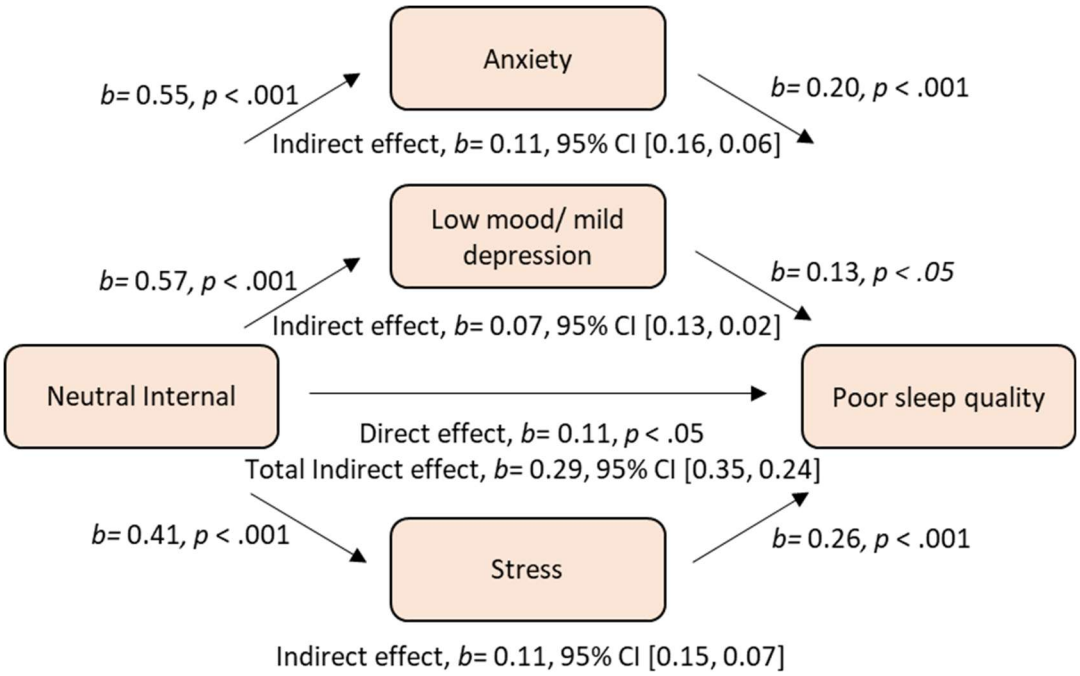

Figure 17. Mediation model of Neutral Internal as a predictor of Poor sleep quality, mediated by Low mood/mild depression, Anxiety and Stress. The confidence interval for the indirect effect is a BCa bootstrapped CI based on 5000 samples

No direct effect was found between neutral internal and stress, however, indirect effects were found for low mood/ mild depression, anxiety and poor sleep quality (Figure 18). This is an example of complete mediation, where the direct effect is eliminated by the mediators.

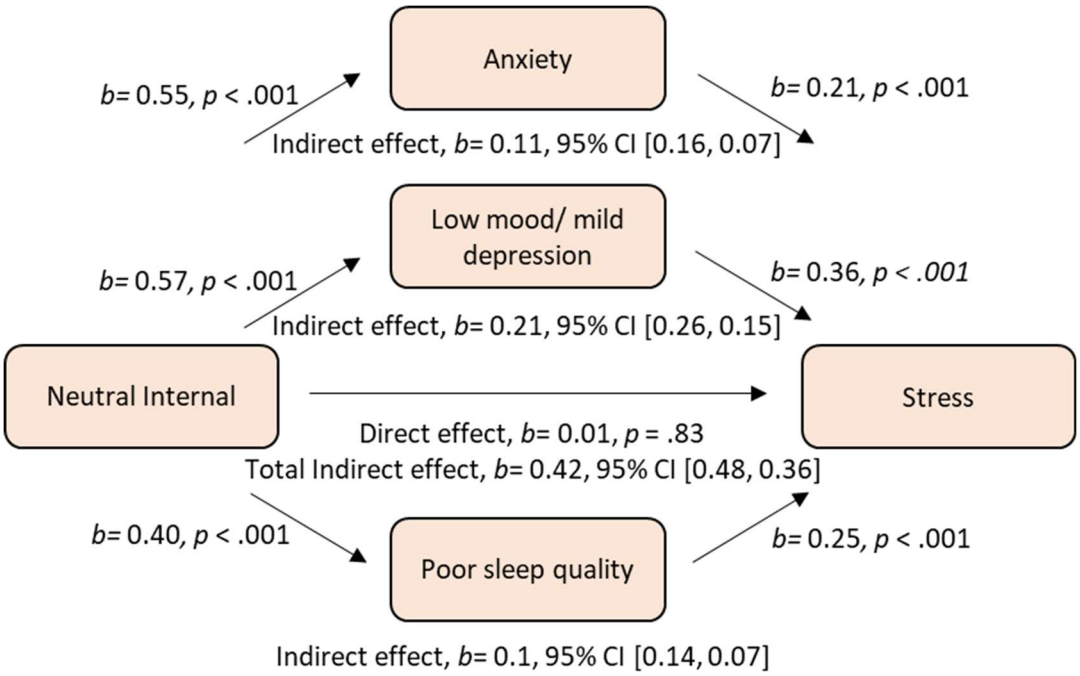

Figure 18. Mediation model of Neutral Internal as a predictor of Stress mediated by Low mood/mild depression, Anxiety and Poor sleep quality. The confidence interval for the indirect effect is a BCa bootstrapped CI based on 5000 samples

4.6.3 Discussion

The most important finding from the mediation analyses was that relationships between mind wandering and well-being are connected to a number of reciprocal mediations. These indicate a complex level of relationships between mind wandering and well-being. For example, while negative mind wandering predicts low mood/mild depression, this relationship is mediated by anxiety and stress, but not poor sleep quality. While mediation does not establish causality, the findings suggest that elements of anxiety and stress associated with negative mind wandering may in part suggest mechanisms for low mood/mild depression. This leads to exploratory hypotheses, such as the prediction that therapies aimed to reduce low mood/mild depression might benefit from focus upon interventions that reduce rumination about anxiety and stress, as well as attempts to reduce rumination that focuses solely upon depressive thoughts. In most of the mediation analyses, the majority of all direct and indirect effects were significant. This suggests that broadband therapeutic interventions are more likely to be successful than focus on one issue alone. In other words, therapy focusing conjointly on stress, anxiety, depression and sleep quality is likely to be more effective. There were two notable cases where complete

mediation was observed. For both negative internal and neutral internal, prediction of stress was eliminated by significant mediation associated with anxiety, low mood/mild depression and poor sleep quality. This suggests the possibility that mind wandering is not directly associated with increased stress, but that anxiety, depression and poor sleep quality caused by mind wandering are an indirect consequence of stress.

Overall, the exploratory findings reported here provide evidence for a variety of distinct pathways of influence that mediate relationships between mind wandering and negative aspects of well-being. The principal conclusion is that while multiple regression demonstrates independent prediction of well-being on the basis of negative internal and neutral internal cognition, mediation analyses indicate that these effects may also operate through a number of indirect pathways. It is hoped that evidence for these indirect pathways will motivate further hypothesis-testing research.

4.7 Internal focus and Mental health conditions

In this section moderation analyses acquired through the SPSS dialogue Process (Hayes, 2013) were performed in order to assess whether the presence of a mental health condition moderated the effects of negative and neutral internal cognition upon well-being. Our hypotheses propose that the effect of internal cognition upon poor well-being are not solely due to the presence of a mental health condition. For example, on one view, effects reported earlier might be eliminated in an analysis in which all people reporting a mental health condition (35.18%) were removed. In order to address this question, we examined whether the presence of a mental health condition moderated the relationship between internal cognition and our mood scales. The critical issue here is that if mental health condition interacts with our predictor variable, this would suggest that effects could be exclusively due to the presence of a mental health condition. We opted for moderation because this provides a more complete perspective and eliminates data loss (note that 35.18% of the sample examined in this section reported a current mental health condition).

Many mental health conditions, such as depression and anxiety, are associated with higher levels of internal cognition (see main introduction). However, we proposed that negative and neutral internal focus negatively impact well-being in the general population

and not just those living with a mental health condition. Moderation analyses reported below enable determination of whether a mental health condition does predict poorer well-being, as well as whether mental health condition interacts with internal cognition. Such an interaction could indicate, for example, that mind wandering only causes depression in people with a mental health condition.

4.7.1 Negative internal cognition and mental health

Low mood/ mild depression

A moderation analysis was performed to predict low mood mild depression from negative internal with mental health condition as a moderator (Table 68). The model statistically predicted low mood/mild depression, $F(3,631) = 245.41$, $p < .001$. Negative internal cognition and presence of a mental health condition added statistically significantly to the prediction, however, there was no significant moderation interaction found.

Table 68

Moderation model Negative Internal predicting Low mood/mild depression with Mental Health Condition as a moderator

	coeff	se(HC3)	t	p
Constant	8.1703	.5218	15.6569	.0000
NegativeI	-.5536	.0677	-8.1727	.0000
MHCCAT	1.4712	.5465	2.6919	.0073
Int_1	-.0135	.0773	-.1748	.8613

Anxiety

A moderation analysis was performed to predict anxiety from negative internal with mental health condition as a moderator (Table 69). The model statistically predicted anxiety, $F(3,631) = 193$, $p < .001$. Mental health condition and neutral internal cognition added statistically significantly to the model. However, there was no significant moderation.

Table 69

Moderation model Negative Internal predicting Anxiety with Mental Health Condition as a moderator

	coeff	se(HC3)	t	p

Constant	7.6254	.5504	13.8547	.0000
NegativeI	-.4324	.0717	-6.0298	.0000
MHCCAT	1.7961	.5779	3.1080	.0020
Int_1	.0249	.0827	.3012	.7634

Poor Sleep quality

A moderation analysis was performed to predict poor sleep quality from negative internal with mental health condition as a moderator (Table 70). The model statistically predicted poor sleep quality, $F(3,631) = 87.522$, $p < .001$. Negative internal and mental health condition added statistically significantly to the model. However, no significant moderation was found.

Table 70

Moderation Model Negative Internal Predicting Poor Sleep Quality with Mental Health Condition as a Moderator

	coeff	se(HC3)	t	p
Constant	6.2304	.4510	13.8154	.0000
NegativeI	-.3240	.0599	-5.4070	.0000
MHCCAT	1.2646	.4905	2.5780	.0102
Int_1	-0.180	.0721	-.2497	.8029

Stress

A moderation analysis was performed to predict stress from negative internal with mental health condition as a moderator (Table 71). The model statistically predicted stress, $F(3,631) = 87.65$, $p < .001$. Negative internal cognition added statistically significantly to the model. However, mental health condition did not, and no significant moderation found.

Table 71

Moderation Model Negative Internal Predicting Stress with Mental Health Condition as a Moderator

	coeff	se(HC3)	t	p
Constant	6.2418	.5664	11.0194	.0000
NegativeI	-.3877	.0733	-5.2927	.0000
MHCCAT	1.0637	.6110	1.7408	.0822
Int_1	-.0531	.0849	-.6260	.5315

4.7.2 Neutral internal cognition and mental health

Low mood/mild depression

A moderation analysis was performed to predict low mood/mild depression from neutral internal with mental health condition as a moderator (Table 72). The model statistically predicted low mood/mild depression, $F(3,631) = 147.15$, $p < .001$. Neutral internal cognition added statistically significantly to the model. However, mental health condition did not predict depression (p=0.084) and there was no significant moderation interaction.

Table 72

Moderation Model Neutral Internal Predicting Low Mood/Mild Depression with Mental Health Condition as a Moderator

	coeff	se(HC3)	t	p
Constant	7.9404	.7942	9.9983	.0000
NeutralI	-.4724	.0953	-4.9579	.0000
MHCCAT	1.4432	.8325	1.7337	.0835
Int_1	.1025	.1049	.9769	.3290

Anxiety

A moderation analysis was performed to predict anxiety from neutral internal with mental health condition as a moderator (Table 73). The model statistically predicted anxiety, $F(3,631) = 175.56$, $p < .001$. Mental health condition and neutral internal cognition added statistically significantly to the model. However, there was no significant moderation.

Table 73

Moderation Model Neutral Internal Predicting Anxiety with Mental Health Condition as a Moderator

	coeff	se(HC3)	t	p
Constant	8.1150	.6990	11.6087	.0000
NeutralI	-.4543	.0848	-5.3599	.0000
MHCCAT	1.4472	.7308	1.9804	.0481
Int_1	.1328	.0933	1.4235	.1551

Poor Sleep quality

A moderation analysis was performed to predict poor sleep quality from neutral internal with mental health condition as a moderator (Table 74). The model statistically predicted sleep quality, $F(3,631) = 87.522$, $p < .001$. Neutral internal and mental health condition added statistically significantly to the model. However, no significant moderation was observed.

Table 74

Moderation Model Neutral Internal Predicting Poor Sleep Quality with Mental Health Condition as a Moderator

	coeff	se(HC3)	t	p
Constant	5.8974	.6696	8.8071	.0000
NeutralI	-.2512	.0851	-2.9524	.0033
MHCCAT	1.8103	.7132	2.5382	.0114
Int_1	-.0348	.0937	-.3710	.7108

Stress

A moderation analysis was performed to predict stress from neutral internal with mental health condition as a moderator (Table 75). The model statistically predicted stress, $F(3,631) = 62.551$, $p < .001$. Neutral internal cognition and mental health condition added statistically significantly to the model, however, there was no significant moderation interaction found.

Table 75

Moderation Model Neutral Internal Predicting Stress with Mental Health Condition as a Moderator

	coeff	se(HC3)	t	p
Constant	5.9640	.6651	8.9671	.0000
NeutralI	-.3160	.0789	-4.0056	.0001
MHCCAT	1.2326	.7346	1.6779	.0939
Int_1	.0128	.0928	.1376	.8906

4.7.3 Discussion

This section examined the effects of frequent internal cognition and negative thoughts upon poor well-being and considered whether this effect might be wholly caused by the presence of a mental health condition. Results demonstrated unambiguously that

this was not the case. Although the presence of a mental health condition typically predicted poorer well-being, this effect was always additive with internal cognition, and there was no evidence for any interaction. Nevertheless, it is very important to consider this potential confound and many studies (e.g. Killingsworth and Gilbert, 2010) did not control for this possibility.

Chapter 5 General discussion

This thesis employed a large questionnaire to measure a range of distinct elements of well-being and revealed a 29-item factor structure in 1045 participants which broadly replicated an earlier questionnaire (N=871). Both studies revealed factors labelled as depression, anxiety, stress, sleep quality, positive affect and motivation (all with high internal consistency) and these were the principal measures of interest in the current study. It is noteworthy that factor scores for these well-being questions were all significantly correlated, typically with medium or more typically large effect sizes.

The questionnaire also probed levels of mind wandering in a smaller sample of 638 participants. This study was cross-sectional, and asked participants to provide reflections on their mood and levels of mind wandering over the last six weeks. Factor analysis of mind wandering questions revealed three types of internal cognition: negative, neutral and positive. As well, a fourth factor revealed a propensity to live in the external versus internal world. Because internal consistency, assessed by Cronbach's Alpha, of positive internal and neutral internal was less than adequate, analyses also examined the predictive value of individual questions focused on mind wandering. On inspection of analyses of the individual internal question it is clear that some of the internal cognition questions were somewhat inadequate in probing the factor in which they were assigned, which could explain the reasons for low factor loadings and low internal consistency. For example, the neutral internal factor "I have frequently found myself lost in my own thoughts" was consistently significantly correlated with the well-being factors and had a strong predictive relationship with all well-being factors. In contrast, the other remaining neutral internal factor question ("Even when I am with other people, I have frequently been lost in my own thoughts") only displayed a significant relationship with anxiety, not with any of the other 5 well-being

factors. Similarly, in the positive internal factor “I frequently like to find time to contemplate” displayed few significant relationships with the well-being factors. However, the question “I have had particular positive internal thoughts and preoccupations that I keep returning to” showed more predictive ability through significant relationships with low mood/mild depression, positive affect and motivation. One approach to tackling this issue would be to alter the questions and to add additional questions with the aim of getting better measurement of latent constructs. For the neutral internal factor, further questions could be added probing general mind wandering such as “I frequently find myself thinking about things I’ve done in the past or what I will do in the future” or “I frequently find myself thinking about things which are neutral, i.e. that are neither happy or sad” or “I often find myself drifting off and thinking about things when I should be doing something else”. In relation to the positive internal factor, questions could be included which provide the reader with an example of positive thoughts to aid memory recall. Examples could be “I frequently find myself thinking of positive things, such as excitement about an upcoming event, feeling grateful or remembering a fun day I had” or “I often find myself drifting off and daydreaming about past and/or future events which are happy”. By including additional questions aiming to probe positive and neutral mind wandering it could be possible to improve the strength of these factors and facilitate a greater predictive ability upon the well-being factors. By improving the nature of the additional questions with the aim of providing the participant with a greater understanding of what the question is asking them, such as providing an example of the thoughts being probed such as excitement, it could avoid confusion and yield more accurate responses to the questions. The result of this could provide a better understanding of the influence of positive and neutral mind wandering upon well-being within the general population.

Analysis of frequencies of reported mind wandering indicated high levels, with 78% of all respondents scoring in the upper half of the scale for the question “I have frequently been lost in my thoughts” supporting Hypothesis 2.2.1 that most people are frequently lost in their own thoughts. Initial correlations indicated strong relationships between levels of negative and neutral mind wandering. However, prevalence of negative mind wandering only predicted positive mind wandering weakly with a negligible effect size. While this significant correlation was a key prediction, the low effect size suggests that the relationship

is not a very clear one and provides only minimal support for Hypothesis 2.2.3 that rates of positive and negative mind wandering are inversely related. The best evidence for an inverse relationship comes from the correlation between individual questions probing frequent positive preoccupations and frequent negative thoughts though again the effect size was small. One explanation for this finding is that the questions in the positive internal cognition factor are not sufficiently precise in probing positive mind wandering and therefore unsuccessful in providing significant relationships with other internal cognition factors as well as well-being factors. As mentioned in the previous paragraph, additional and adapted questions in the positive internal cognition factor, which add clarity to what the question is specifically asking, could generate more accurate responses from participants and therefore more accurate results. A further potential reason behind these findings could be related to reliability of cross-sectional methodology. A large portion of previous research examined mind wandering through experience sampling, a method of obtaining samples in real time by prompting the participant during daily life via a mobile app or similar device (such as Killingsworth and Gilbert, 2010). The benefit of this methodology is that it allows researchers to analyse mind wandering as it happens, which provides more accurate responses compared to a questionnaire that ask participants to remember mind wandering events a number of weeks previous to completing the questionnaire. In this instance it could be possible that by using experience sampling instead of a cross-sectional approach we would have been able to specifically analyse when a participant had positive or negative mind wandering episodes. We would then be able to examine the relationship more accurately between the two internal cognition factors and potentially find more significant results. Although it is true that by using a cross-sectional approach in the current study we may have lost some resolution in our examination of mind wandering, but by using this method we have also been able to broaden the number of well-being variables analysed. It would be unlikely that within an experience sampling study it would probe as many as 29 aspects of well-being and almost certainly not with as much detail as found in the current study. Arguably, an experience sampling study could probe aspects of well-being, but it would be on a much smaller scale and one wouldn't be able to address mediating effects of well-being variables upon mind wandering. Correlations also indicated that a propensity to live in the external world predicted lower levels of neutral negative and positive mind wandering. These findings support Hypothesis 2.2.4 that the more one mind wanders the

less one is externally focused and are reassuring by suggesting the external cognition factor has some predictive validity.

Supporting Hypothesis 2.3.2, regression analyses revealed that negative mind wandering predicted poorer well-being in terms of levels of depression, anxiety, sleep quality, stress, positive affect and motivation. Higher levels of neutral mind wandering also predicted poorer well-being in terms of depression, anxiety, sleep quality, stress and motivation. Dominance analyses indicated that negative mind wandering was the strongest predictor in all cases and exerted complete dominance over all regression models, including the one predicting positive affect.

Unexpectedly, a propensity for external versus internal cognition only predicted levels of motivation and none of the other well-being factors. This provides only limited support for hypothesis 2.3.4 that a preference for external focus will predict better well-being and thus weak support for Nix, et al., (1995) who argued that external focus predicts better well-being. However, on inspection of the external cognition questions, “prefer to live in the real world” significantly predicted increased positive affect and reduced low mood/mild depression and “enjoyed daydreaming” significantly predicted reduced motivation and low mood/mild depression. This could suggest that the absence of effects of the external cognition factor may reflect shared variance with our mind wandering factors. The observed lack of significant findings here could also be a result of ambiguity of the external cognition factor questions. As mentioned previously in section 4.4.2 on the basis of discussion of regressions predicting well-being factors from internal cognition factors, it is suggested that “I have preferred living in the real world rather than my own thoughts” could receive a high score from participants who have frequent internal thoughts and would prefer to spend more time in the real world away from them. This is opposed to high scores on this question only coming from participants who spend little time mind wandering and a majority of time externally focused. Future studies should aim to resolve this issue by removing “preferred” from the question, for example “Over the last six weeks I have spent more time living in the “real world” rather than in my own thoughts”. Finally, it can also be suggested that by using an experience sampling method, compared to a cross-sectional one used in the current study, it would be more accurate in examining a tendency to spend time

externally focused as samples are collected in real time rather than asking for the participant to remember externally focused events.

Finally, a tendency to mind wander to positive content predicted lower levels of depression, enhanced positive affect and motivation but did not predict anxiety, stress, or sleep quality. The relationship between positive mind wandering and depression is consistent with the fact that anhedonia is a key symptom of depression. Regressions which focused on all 9 individual questions revealed similar patterns and in all cases the question probing frequent negative preoccupations exerted complete dominance in all six regression models.

One argument is that our results may be caused by higher levels of mind wandering in participants reporting a mental health condition. Through moderation analyses we showed that while mental health condition predicts poorer well-being this effect is additive rather than a complete explanation of current findings.

Analyses also examined whether the six well-being factors predicted the four internal cognition factors. While these analyses are conceptually similar to the reverse form of regression reported previously, they provide independent assessment of influences of shared variance. Depression predicted levels of negative, neutral and positive mind wandering and demonstrated complete dominance over the other 5 well-being measures. Anxiety, poor sleep quality and stress each predicted levels of negative and neutral internal mind wandering but not positive mind wandering or external focus. Positive affect predicted negative and positive mind wandering but not neutral mind wandering or external focus. Finally, motivation predicted all three forms of mind wandering. Moreover, higher motivation also predicted higher levels of external versus internal focus.

Later analyses considered the possibility that relationships between mind wandering and well-being might be mediated by elements of well-being. These analyses focused only upon negative and neutral mind wandering factors and only on negative aspects of well-being (depression, stress, anxiety and poor sleep quality). For example, is the relationship between negative mind wandering and anxiety mediated by poor sleep quality? While these analyses are complex, they are based on the known complex relationships between different facets of well-being and disentangling these relationships is critical when

considering best practice clinical interventions (e.g. Pace-Schott, Germain and Milad, 2015; Cox and Olatunji, 2016, Kahn, Sheppes and Sadeh, 2013). For depression, our findings indicate that all direct and indirect mediations were significant except that poor sleep quality did not mediate the relationship between negative mind wandering and depression. For anxiety, all direct effects and indirect pathways were also significant. For sleep quality, all direct and indirect pathways were significant, with the exception that depression did not mediate the relationship between negative mind wandering and sleep quality. These findings indicate that treatments for low mood connected with mind wandering should focus on factors such as depression, anxiety and sleep quality simultaneously. For stress, the direct pathway between negative and neutral mind wandering was rendered insignificant indicating a complete mediation, even though prior regression analyses indicated that negative and neutral mind wandering predicted stress levels. For both negative and neutral mind wandering, all indirect pathways were significant. The findings for stress suggest that mind wandering is not directly responsible for stress but leads to elevated stress via mediating effects of sleep quality, anxiety and depression.

A limitation of this study was that a majority of participants were recruited from the university cohort, without a wide range of ages in the sample our findings do not accurately represent the general population. Recruiting a high level of students also impacts our findings as academic stress may be more prevalent in this sample and this could fluctuate in response to the time of year the questionnaire was completed, for example during exam season. Another limitation is that the factor structure of the positive and neutral internal cognition factors is relatively weak, and Cronbach's alpha displayed low internal consistency of both the positive internal and neutral internal cognition factors. In future research we suggest that more questions probing positive internal and general frequency of neutral mind wandering should be created, examples given in previous paragraphs. Finally, it is important to note that the act of completing the questionnaire is inherently an internal process which asks the participant to bring focus upon themselves and to essentially mind wander. Therefore, results may be biased towards scoring highly on mind wandering scales because the individual is currently mind wandering whilst completing the questionnaire. The mind wandering questions also appear after the general well-being items probing depression, anxiety, stress for example, consequentially some participants may have

unearthed strong emotions prior to completing the mind wandering questions which may potentially have influenced their scores on the mind wandering questions which probe negative and positive content. Future research may look at the contrast between presenting the mind wandering questions prior to completing questions on well-being and emotion and presenting them after the well-being questions.

The results of the current study confirm that internal cognition is a frequent process engaged in by the majority of the general population and propensity for this activity is a strong predictor of well-being. Future research should investigate whether our trait-like measures predict tendency to mind wander in experience sampling paradigms or when performing laboratory tasks. Future research should also extend to considerations of spontaneous versus deliberate mind wandering. Questions probing positive and neutral mind wandering should be less ambiguous and these improvements have been made in an ongoing replication of the current study.

References

Ağargün, M. Y., Kara, H., & Solmaz, M. (1997). Sleep disturbances and suicidal behavior in patients with major depression. *The Journal of clinical psychiatry*.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.

Antrobus, J. S. (1968). Information theory and stimulus-independent thought. *British Journal of Psychology*, *59*(4), 423-430.

Azen, R., & Budescu, D. V. (2003). The dominance analysis approach for comparing predictors in multiple regression. *Psychological methods*, *8*(2), 129.

Baird, B., Smallwood, J., Mrazek, M. D., Kam, J. W., Franklin, M. S., & Schooler, J. W. (2012). Inspired by distraction: Mind wandering facilitates creative incubation. *Psychological science*, *23*(10), 1117-1122.

Berridge, K. C., & Kringelbach, M. L. (2011). Building a neuroscience of pleasure and well-being. *Psychology of Well-Being: Theory, Research and Practice, 1(*1), 3.

Berridge, K. C., & Kringelbach, M. L. (2015). Pleasure systems in the brain. *Neuron, 86*(3), 646-664

Buckner, R. L., Andrews-Hanna, J. R., & Schacter, D. L. (2008). The brain's default network: anatomy, function, and relevance to disease.

Callard, F., Smallwood, J., Golchert, J., & Margulies, D. S. (2013). The era of the wandering mind? Twenty-first century research on self-generated mental activity. *Frontiers in psychology*, *4*, 891.

Carciofo, R., Du, F., Song, N., & Zhang, K. (2014). Mind wandering, sleep quality, affect and chronotype: an exploratory study. *PloS one*, *9*(3).

Christoff, K., Irving, Z. C., Fox, K. C., Spreng, R. N., & Andrews-Hanna, J. R. (2016). Mind-wandering as spontaneous thought: a dynamic framework. *Nature Reviews Neuroscience*, *17*(11), 718.

Clark, D. M., & Teasdale, J. D. (1985). Constraints on the effects of mood on memory. *Journal of personality and social psychology*, *48*(6), 1595.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. New Jersey, US: Lawrence Erlbaum Associates

Coles, M. E., Schubert, J. R., & Nota, J. A. (2015). Sleep, circadian rhythms, and anxious traits. *Current psychiatry reports*, *17*(9), 73.

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological review*, *107*(2), 261.

Cox, R. C., & Olatunji, B. O. (2016). A systematic review of sleep disturbance in anxiety and related disorders. *Journal of anxiety disorders*, *37*, 104-129.

Darlington, R. B., & Hayes, A. F. (2016). *Regression analysis and linear models: Concepts, applications, and implementation*. Guilford Publications.

DeVellis, R. F. (2016). *Scale development: Theory and applications* (Vol. 26). Sage publications.

Domhoff, G. W. (2011). The neural substrate for dreaming: Is it a subsystem of the default network?. *Consciousness and cognition*, *20*(4), 1163-1174.

Domhoff, G. W., & Fox, K. C. (2015). Dreaming and the default network: A review, synthesis, and counterintuitive research proposal. *Consciousness and cognition, 33*, 342-353.

Drevets, W. C., Savitz, J., & Trimble, M. (2008). The subgenual anterior cingulate cortex in mood disorders. *CNS spectrums*, *13*(8), 663.

Fischer, A. S., Keller, C. J., & Etkin, A. (2016). The clinical applicability of functional connectivity in depression: Pathways toward more targeted intervention. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, *1*(3), 262-270.

Forster, S., Nunez Elizalde, A. O., Castle, E., & Bishop, S. J. (2015). Unraveling the anxious mind: anxiety, worry, and frontal engagement in sustained attention versus off-task processing. *Cerebral Cortex*, *25*(3), 609-618.

Fox, K. C., Spreng, R. N., Ellamil, M., Andrews-Hanna, J. R., & Christoff, K. (2015). The wandering brain: Meta-analysis of functional neuroimaging studies of mind-wandering and related spontaneous thought processes. *Neuroimage*, *111*, 611-621.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer publishing company.

Franklin, G., Carson, A. J., & Welch, K. A. (2016). Cognitive behavioural therapy for depression: systematic review of imaging studies. *Acta neuropsychiatrica*, *28*(2), 61-74.

Franklin, M. S., Mrazek, M. D., Anderson, C. L., Smallwood, J., Kingstone, A., & Schooler, J. (2013). The silver lining of a mind in the clouds: Interesting musings are associated with positive mood while mind-wandering. *Frontiers in psychology*, *4*, 583.

Giambra, L. M., & Grodsky, A. (1989). Task-unrelated images and thoughts while reading. In Imagery (pp. 27-31). Springer, Boston, MA.

Gobin, C. M., Banks, J. B., Fins, A. I., & Tartar, J. L. (2015). Poor sleep quality is associated with a negative cognitive bias and decreased sustained attention. *Journal of sleep research*, *24*(5), 535-542.

Gotlib, I. H., & Joormann, J. (2010). Cognition and depression: current status and future directions. *Annual review of clinical psychology*, *6*, 285-312.

Green, J. D., Sedikides, C., Saltzberg, J. A., Wood, J. V., & Forzano, L. A. B. (2003). Happy mood decreases self-focused attention. *British Journal of Social Psychology*, *42*(1), 147-157.

Gross, R. T., & Borkovec, T. D. (1982). Effects of a cognitive intrusion manipulation on the sleep-onset latency of good sleepers. *Behavior Therapy*, *13*(1), 112-116.

Gusnard, D. A., & Raichle, M. E. (2001). Searching for a baseline: functional imaging and the resting human brain. *Nature reviews neuroscience, 2*(10), 685-694.

Hayes, A. F. (2013). Mediation, moderation, and conditional process analysis. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach edn. New York: Guilford Publications*, 1-20.

Hamilton, N. A., Nelson, C. A., Stevens, N., & Kitzman, H. (2007). Sleep and psychological well-being. *Social Indicators Research, 82*(1), 147-163.

Herbet, G., Lafargue, G., de Champfleur, N. M., Moritz-Gasser, S., Le Bars, E., Bonnetblanc, F., & Duffau, H. (2014). Disrupting posterior cingulate connectivity disconnects consciousness from the external environment. Neuropsychologia, 56, 239-244.

Hoffmann, F., Banzhaf, C., Kanske, P., Bermpohl, F., & Singer, T. (2016). Where the depressed mind wanders: Self-generated thought patterns as assessed through experience sampling as a state marker of depression. *Journal of affective disorders*, *198*, 127-134.

Huba, G. J., Aneshensel, C. S., & Singer, J. L. (1981). Development of scales for three second-order factors of inner experience. *Multivariate Behavioral Research*, *16*(2), 181-206.

Johnson, E. O., Roth, T., & Breslau, N. (2006). The association of insomnia with anxiety disorders and depression: exploration of the direction of risk. *Journal of psychiatric research*, *40*(8), 700-708.

Kahn, M., Sheppes, G., & Sadeh, A. (2013). Sleep and emotions: bidirectional links and underlying mechanisms. *International Journal of Psychophysiology, 89*(2), 218-228.

Kane, M. J., Brown, L. H., McVay, J. C., Silvia, P. J., Myin-Germeys, I., & Kwapil, T. R. (2007). For whom the mind wanders, and when: An experience-sampling study of working memory and executive control in daily life. Psychological Science, 18, 614 – 621.

Kelley, K., & Maxwell, S. E. (2003). Sample size for multiple regression: obtaining regression coefficients that are accurate, not simply significant. *Psychological methods*, *8*(3), 305.

Killingsworth, M. A., & Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science*, *330*(6006), 932-932.

Kline, R. B. (2005). Methodology in the social sciences.

Klinger, E., Singer, J. A., & Salovey, P. (1999). Thought flow: Properties and mechanisms underlying shifts in content At play in the fields of consciousness: Essays in honor of Jerome L.

Klinger, E. (1996). The contents of thoughts: Interference as the downside of adaptive normal mechanisms in thought flow.

Klinger, E., Gregoire, K. C., & Barta, S. G. (1973). Physiological correlates of mental activity: Eye movements, alpha, and heart rate during imagining, suppression, concentration, search, and choice. *Psychophysiology*, *10*(5), 471-477.

Klinger, E., Henning, V. R., & Janssen, J. M. (2009). Fantasy-proneness dimensionalized: Dissociative component is related to psychopathology, daydreaming as such is not. *Journal of Research in Personality*, *43*(3), 506-510.

Kucyi, A., & Davis, K. D. (2014). Dynamic functional connectivity of the default mode network tracks daydreaming. *Neuroimage*, *100*, 471-480.

Kringelbach, M. L., & Berridge, K. C. (2010). The functional neuroanatomy of pleasure and happiness. *Discovery medicine*, *9*(49), 579.

Lakhan, S. E., & Callaway, E. (2010). Deep brain stimulation for obsessive-compulsive disorder and treatment-resistant depression: systematic review. *BMC research notes*, *3*(1), 60.

Lant, N. D., Gonzalez-Lara, L. E., Owen, A. M., & Fernández-Espejo, D. (2016). Relationship between the anterior forebrain mesocircuit and the default mode network in the structural bases of disorders of consciousness. *NeuroImage: Clinical*, *10*, 27-35.

Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Barrett, L. F. (2012). The brain basis of emotion: a meta-analytic review. *Behavioral and brain sciences, 35*(03), 121-143.

Lund, H. G., Reider, B. D., Whiting, A. B., & Prichard, J. R. (2010). Sleep patterns and predictors of disturbed sleep in a large population of college students. *Journal of adolescent health*, *46*(2), 124-132.

Lyubomirsky, S., & Nolen-Hoeksema, S. (1995). Effects of self-focused rumination on negative thinking and interpersonal problem solving. *Journal of personality and social psychology*, *69*(1), 176.

Ma, N., Dinges, D. F., Basner, M., & Rao, H. (2015). How acute total sleep loss affects the attending brain: a meta-analysis of neuroimaging studies. *Sleep*, *38*(2), 233-240.

Marchetti, I., Van de Putte, E., & Koster, E. H. (2014). Self-generated thoughts and depression: from daydreaming to depressive symptoms. *Frontiers in human neuroscience*, *8*, 131.

Mathews, A. (1990). Why worry? The cognitive function of anxiety. *Behaviour research and therapy*, *28*(6), 455-468.

Mazure, C. M. (1998). Life stressors as risk factors in depression. *Clinical Psychology: Science and Practice*, *5*(3), 291-313.

McGonagle, K. A., & Kessler, R. C. (1990). Chronic stress, acute stress, and depressive symptoms. *American journal of community psychology*, *18*(5), 681-706.

McLaughlin, K. A., & Nolen-Hoeksema, S. (2011). Rumination as a transdiagnostic factor in depression and anxiety. *Behaviour research and therapy*, *49*(3), 186-193.

McVay, J. C., & Kane, M. J. (2009). Conducting the train of thought: working memory capacity, goal neglect, and mind wandering in an executive-control task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35*(1), 196.

McVay, J. C., & Kane, M. J. (2010). Does mind wandering reflect executive function or executive failure? Comment on Smallwood and Schooler (2006) and Watkins (2008).

Menon, V. (2011). Large-scale brain networks and psychopathology: a unifying triple network model. *Trends in cognitive sciences, 15*(10), 483-506.

Merlo, K. L., Wiegand, K. E., Shaughnessy, S. P., Kuykendall, L. E., & Weiss, H. M. (2019). A qualitative study of daydreaming episodes at work. *Journal of Business and Psychology*, 1-20.

Mikulincer, M., Babkoff, H., Caspy, T., & Weiss, H. (1990). The impact of cognitive interference on performance during prolonged sleep loss. *Psychological research*, *52*(1), 80-86.

Mulders, P. C., van Eijndhoven, P. F., Schene, A. H., Beckmann, C. F., & Tendolkar, I. (2015). Resting-state functional connectivity in major depressive disorder: a review. *Neuroscience & Biobehavioral Reviews*, *56*, 330-344.

Mental Health Foundation. (2018). Stressed nation: 74% of UK 'overwhelmed or unable to cope' at some point in the past year. Retrieved January 3rd, 2020, from https://www.mentalhealth.org.uk/news/stressed-nation-74-uk-overwhelmed-or-unable-cope-some-point-past-year

Nix, G., Watson, C., Pyszczynski, T., & Greenberg, J. (1995). Reducing depressive affect through external focus of attention. *Journal of Social and Clinical Psychology*, *14*(1), 36-52.

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of abnormal psychology*, *100*(4), 569.

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of abnormal psychology*, *109*(3), 504.

Nunally, J. C., & Bernstein, I. (1978). Psychometric theory. Ed. *NY: McGraw-Hill*.

Nutt, D., Wilson, S., & Paterson, L. (2008). Sleep disorders as core symptoms of depression. *Dialogues in clinical neuroscience*, *10*(3), 329.

Pace-Schott, E. F., Germain, A., & Milad, M. R. (2015). Effects of sleep on memory for conditioned fear and fear extinction. *Psychological bulletin, 141*(4), 835.

Pannekoek, J. N., Veer, I. M., van Tol, M. J., van der Werff, S. J., Demenescu, L. R., Aleman, A., ... & van der Wee, N. J. (2013). Resting-state functional connectivity abnormalities in limbic and salience networks in social anxiety disorder without comorbidity. *European neuropsychopharmacology*, *23*(3), 186-195.

Pessoa, L., & McMenamin, B. (2017). Dynamic networks in the emotional brain. The Neuroscientist, 23(4), 383-396.

Poerio, G. L., Totterdell, P., & Miles, E. (2013). Mind-wandering and negative mood: Does one thing really lead to another?. *Consciousness and cognition*, *22*(4), 1412-1421.

Posner, J., Hellerstein, D. J., Gat, I., Mechling, A., Klahr, K., Wang, Z., ... & Peterson, B. S. (2013). Antidepressants normalize the default mode network in patients with dysthymia. *JAMA psychiatry*, *70*(4), 373-382.

Quirk, G. J., & Gross, J. J. (2007). Handbook of Emotion Regulation.

Raes, F. (2010). Rumination and worry as mediators of the relationship between self-compassion and depression and anxiety. *Personality and Individual Differences*, *48*(6), 757-761.

Raichle, M. E., MacLeod, A. M., Snyder, A. Z., Powers, W. J., Gusnard, D. A., & Shulman, G. L. (2001). A default mode of brain function. *Proceedings of the National Academy of Sciences*, *98*(2), 676-682.

Randall, J. G., Oswald, F. L., & Beier, M. E. (2014). Mind-wandering, cognition, and performance: A theory-driven meta-analysis of attention regulation. *Psychological bulletin*, *140*(6), 1411.

Robison, M. K., Gath, K. I., & Unsworth, N. (2017). The neurotic wandering mind: An individual differences investigation of neuroticism, mind-wandering, and executive control. *The Quarterly Journal of Experimental Psychology*, *70*(4), 649–663.

Schacter, D. L., Addis, D. R., Hassabis, D., Martin, V. C., Spreng, R. N., & Szpunar, K. K. (2012). The future of memory: remembering, imagining, and the brain. *Neuron*, *76*(4), 677-694.

Seli, P., Cheyne, J. A., Xu, M., Purdon, C., & Smilek, D. (2015). Motivation, intentionality, and mind wandering: Implications for assessments of task-unrelated thought. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 41*(5), 1417.

Shallice, T. (1982). Specific impairments of planning. *Philosophical Transactions of the Royal Society of London. B, Biological Sciences*, *298*(1089), 199-209.

Singer, J. A., & Salovey, P. (1999). Thought flow: Properties and mechanisms underlying shifts in content. In *At play in the fields of consciousness* (pp. 43-64). Psychology Press.

Singer, J. L. (1955). Delayed gratification and ego development: implications for clinical and experimental research. *Journal of consulting psychology*, *19*(4), 259.

Singer, J. L. (1975). Navigating the stream of consciousness: Research in daydreaming and related inner experience. *American Psychologist*, *30*(7), 727–738.

Singer, J. L. (1975). Navigating the stream of consciousness: Research in daydreaming and related inner experience. *American Psychologist*, *30*(7), 727.

Singer, J. L., and Antrobus, J. S. (1966, Revised 1970). *Imaginal Processes Inventory [by] Jerome L. Singer and John S. Antrobus*. New York, NY: Center for Research in Cognition and Affect Graduate Center, City University of New York.

Smallwood, J. (2013). Distinguishing how from why the mind wanders: a process–occurrence framework for self-generated mental activity. *Psychological bulletin*, *139*(3), 519.

Smallwood, J., & Schooler, J. W. (2006). The restless mind. *Psychological bulletin*, *132*(6), 946.

Smallwood, J., Brown, K., Baird, B., & Schooler, J. W. (2012). Cooperation between the default mode network and the frontal–parietal network in the production of an internal train of thought. *Brain research*, *1428*, 60-70.

Smallwood, J., Fitzgerald, A., Miles, L. K., & Phillips, L. H. (2009). Shifting moods, wandering minds: negative moods lead the mind to wander. *Emotion*, *9*(2), 271.

Smallwood, J., Tipper, C., Brown, K., Baird, B., Engen, H., Michaels, J. R., ... & Schooler, J. W. (2013). Escaping the here and now: evidence for a role of the default mode network in perceptually decoupled thought. *Neuroimage*, *69*, 120-125.

Smith, B. (2013). Depression and motivation. *Phenomenology and the Cognitive Sciences*, 12(4), 615-635.

Solms, M. (2000). Dreaming and REM sleep are controlled by different brain mechanisms. *Behavioral and Brain Sciences, 23*(6), 843-850.

Sood, A., & Jones, D. T. (2013). On mind wandering, attention, brain networks, and meditation. *Explore*, *9*(3), 136-141.

Spreng, R. N., Mar, R. A., & Kim, A. S. (2009). The common neural basis of autobiographical memory, prospection, navigation, theory of mind, and the default mode: a quantitative meta-analysis. *Journal of cognitive neuroscience, 21*(3), 489-510.

Spreng, R. N., Stevens, W. D., Chamberlain, J. P., Gilmore, A. W., & Schacter, D. L. (2010). Default network activity, coupled with the frontoparietal control network, supports goal-directed cognition. *Neuroimage*, *53*(1), 303-317.

Takano, K., Iijima, Y., & Tanno, Y. (2012). Repetitive thought and self-reported sleep disturbance. *Behavior Therapy*, *43*(4), 779-789.

Thomsen, D. K., Mehlsen, M. Y., Christensen, S., & Zachariae, R. (2003). Rumination—relationship with negative mood and sleep quality. *Personality and Individual Differences, 34*(7), 1293-1301.

Urry, H. L., Van Reekum, C. M., Johnstone, T., Kalin, N. H., Thurow, M. E., Schaefer, H. S., ... & Davidson, R. J. (2006). Amygdala and ventromedial prefrontal cortex are inversely coupled during regulation of negative affect and predict the diurnal pattern of cortisol secretion among older adults. *Journal of Neuroscience*, *26*(16), 4415-4425.

Vanhaudenhuyse, A., Demertzi, A., Schabus, M., Noirhomme, Q., Bredart, S., Boly, M., ... & Laureys, S. (2011). Two distinct neuronal networks mediate the awareness of environment and of self. *Journal of cognitive neuroscience*, *23*(3), 570-578.

Vinski, M. T., & Watter, S. (2013). Being a grump only makes things worse: A transactional account of acute stress on mind wandering. *Frontiers in Psychology*, *4*(NOV), 1–12.

Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1988). *Cognitive psychology and emotional disorders*. John Wiley & Sons.

Williamson, T. (2006). Can cognition be factorised into internal and external components?. *Contemporary debates in cognitive science*, 291-306.

Wilson, T. D., Reinhard, D. A., Westgate, E. C., Gilbert, D. T., Ellerbeck, N., Hahn, C., ... & Shaked, A. (2014). Just think: The challenges of the disengaged mind. *Science*, *345*(6192), 75-77.

Wood, J. V., Saltzberg, J. A., & Goldsamt, L. A. (1990). Does affect induce self-focused attention?. *Journal of personality and social psychology*, *58*(5), 899.

Yanko, M. R., & Spalek, T. M. (2014). Driving with the wandering mind: the effect that mind-wandering has on driving performance. *Human factors*, *56*(2), 260-269.

Yates, W. R., Mitchell, J., Rush, A. J., Trivedi, M., Wisniewski, S. R., Warden, D., ... & Gaynes, B. N. (2007). Clinical features of depression in outpatients with and without co-occurring general medical conditions in STAR* D: confirmatory analysis. *Primary care companion to the Journal of clinical psychiatry*, *9*(1), 7.

Appendix

Appendix A: 45 well-being domains identified within existing peer-reviewed assessments of well-being.

1 Anxiety	Lovibond & Lovibond (1995); Spielberger et al. (1970)	24 Existential concerns	Cohen et al. (1995)
2 Stress	Schulz et al. (2004); Levenstein et al. (1993)	25 Sexual well-being	WHOQOL (1994); Cummins (1997)
3 Depression	Beck (1961); Joseph et al. (2004)	26 Job satisfaction	Alfonso et al. (1996); Schulz et al. (2004)
4 Happiness	Lyumbomirsy & Lepper (1999); Fordyce (1988)	27 Having a purpose	Crumbaugh & Maholick (1964); Daaleman & Frey (2004)
5 General Positive Affect	Watson et al. (1988); Deiner et al. (2010); Cantril (1965)	28 Work life balance	Kahneman et al. (2004); Cummins (1997)
6 General Negative Affect	Watson et al. (1988); Deiner et al. (2010); Cantril (1965)	29 Goals & Achievements	Neugarten & Havighurst (1961); Crumbaugh & Maholick (1964)
7 Satisfaction with life	Deiner et al. (1985); Pavot et al. (1998)	30 Comfort from religious/philosophical grounding	Daaleman & Frey (2004); WHOQOL (1994)
8 Fatigue/energy /vitality	Thayer (1986); McNair et al. (1989); Steyer et al. (1997)	31 Negative life events (e.g. bereavement)	Wills et al. (1992); Cochrane and Robinson (1973)
9 Physical functioning/ Physical well-being	Chambers (1976); Linn & Linn (1984)	32 Well-being as a temporally extended concept	Pavot et al. (1998)
10 Ability to communicate	Steinbuchel et al. (2010); Teasdale et al. (1997)	33 Success of adaptation to adversity	Bonanno et al. (2011); Carver et al. (1989); Lezak & Malec (2008)
11 Functional independence	Hall et al. (1993); WHOQOL (1994)	34 Personal Resilience	Bonanno et al. (2011); Carver et al. (1989); Gagne (2003)
12 Social functioning/interpersonal relationships	Cummins (1997); Alderman et al. (2011)	35 Concern and care for others	Sockeel et al. (2006)
13 Family support	Alfonso et al. (1996); Lezak &Malec 2008)	36 Comfort with life "environment"	Lawton (1982); Harrison-Felix (2001)
14 Relationship support	WHOQOL (1994); Lawton (1982)	37 Creative endeavours/functional engagement	Bech (1998); Waterman et al. (2010)

15 Eudaimonic measures	Waterman et al. (2010); Gagne (2003); Diener et al. (2010)	38 Productivity	Carver et al. (1989); Cummins (1997)
16 Pain	Lezak & Malec (2008); Clark et al. (2002)	39 Novelty/sensation seeking	Sockeel et al. (2006)
17 Motivation	Sockeel et al. (2006); Steinbuchel et al. (2010)	40 Emotional reactivity	Sockeel et al. (2006)
18 Self-esteem	Rosenberg (1965); Heatherton & Polivy (1991)	41 Cognitive ability	Lawton (1982); Hall et al. (1993)
19 Optimism	Scheier & Carver (1985); Neugarten & Havighurst (1961)	42 Worry	Ware (1976); Lawton (1972)
20 Social Support	Carver et al. (1989); Harrison-Felix (2001)	43 Isolation/loneliness	Russel (1996); Teasdale et al. (1997)
21 Reward/Experienced Reward	Neugarten & Havighurst (1961); Levenstein et al. (1993); Lang (1980)	44 Locus of control	Dupuy (1997); Harrison-Felix (2001)
22 Financial security	Cummins (1997); Alfonso et al. (1996)	45 Respect/equality	Steinbuchel et al. (2010); Alderman et al. (2011)
23 Freedom & Time	Lawton (1982); Veit & Ware (1983)		

Appendix B: 105 existing peer reviewed and published instruments, which have been used to assess a range of well-being

	Test Name	Reference	Sub scales	Items	Sclaes	State vs Trait	Domains measured
1	Activation Deactivation Adjective Check List	(ADACL; Thayer, 1986)	Energy Tiredness Tension Calmness	50	4	State	8
2	Affect Intensity measure	(Larson, 1983)	Emotional intensity	40	1	Trait	40

3	Affectometer 2	(Kammann and Flett, 1983)	Well-being	40	1		12, 5, 6, 7, 8, 19, 32
4	The Emotional Quotient Inventory (EQ-i)	Bar-On, R. (2004)	Interpersonal Intrapersonal Stress management Adaptability General Mood	125	5		2 5, 6, 12, 18, 19, 33, 46
5	Basic need satisfaction Scale	(Gagné, 2003)	Autonomy Competence Relatedness	21	3	Trait	15, 20, 34
6	Becks Depression Inventory	(BDI; Beck, 1961)	Depression	21	1	Trait	3
7	Brief approach avoidance coping questionnaire	Finset et al., 2002	Coping	12		Trait	33
8	Center for Epidemiologic Studies Depression Scale	(CED-S; Radloff, 1977)	Depression	20	1	Trait	3, 4, 5, 6, 18, 19
9	Comprehensive Quality of Life Scale: Adult	(ComQol-A5; Cummins, 1997)	Physical well-being Social functioning Engagement General Affect Intimacy Security Finance	34	7	Trait	4, 5, 6, 7, 8, 9, 12, 22, 23, 25, 28, 36, 37, 38
10	Curiosity and Exploration Inventory (CEI-II)	Kashdann et al., 2009	Stretching Embracing	10	2	Trait	17, 38, 39
11	Delighted/terrible scale	(Andrews and Withey, 1976)	Life satisfaction	1	1	Trait	7
12	Depression anxiety stress scale	(DASS; Lovibond & Lovibond, 1995)	Depression Anxiety Stress	42	3		1, 2, 3
13	Emotional Intelligence scale	(Schutte et al., 1998)	Appraisal and expression of emotion Regulation of emotion Utilisation of emotion	33	1	Trait	46

14	EQ5D	The EuroQol Group (1990)	Health State Mobility Self-care Usual activities Pain/discomfort Anxiety/depression	6	1		1, 3, 9, 11, 16,

15	European Brain Injury Questionnaire	(Teasdale et al., 1997)	Energy Physical well-being Motivation Impulsivity Depression Isolation/loneliness Communication	66	8	Trait	3, 8, 9, 10, 11, 17, 42
16	Flourishing Scale	(Diener et al., 2010)	Eudiamonic	8	1	Trait	15, 19, 20, 27, 34, 37
17	Functional Independence Measure and Functional Assessment	(Hall, Gordon and Zasler, 1993)	Functional Independence Cognition Motor	18	2	Trait	3, 11, 12, 41
18	Geriatric Depression Scale	Yesavage et al., (1982)	Depression	30	1		3, 4, 7, 8, 12, 27, 34, 38
19	Hamilton depression rating scale	(Hamilton, 1960)	Depression	17	1	Trait	1, 3, 8, 9, 25, 37, 41
20	Health Utilities Index	(Torrance and Feeny, 1990)	Vision, hearing, speech, ambulation, dexterity, emotion, cognition, and pain	31	8	Trait	9, 16, 41
21	Life Orientation Test (LOT)	Scheier and Carver (1985)	Optimism	12	1	Trait	19
22	Mayo-Portland Adaptability Inventory - 4	(Lezak and Malec, 2008)	Ability Adjustment Participation	35	3	Trait	1, 2, 8, 9, 11, 13, 14, 23, 16, 22, 33, 34, 36, 37, 43, 45

23	McGill Quality of Life Questionnaire	(Cohen et al., 1995)	Physical symptoms Psychological symptoms Existential well-being Support	16	4	Trait	5, 6, 20, 24,
24	McMaster Health Index Questionnaire	(MHIQ; Chambers, 1976)	Physical function Emotional function Social function	59	3	Trait	5, 6, 9, 11, 12, 13, 14, 18, 19, 20, 22
25	Meaning in Life Questionnaire (MLQ)	Steger et al., 2006	Meaning in life	10	1	Trait	24, 27
26	Medical Outcomes Study 36-Item ShortForm Health Survey	(SF-36; Ware & Sherbourne, 1992)	Physical functioning Role limitations - Physical Bodily Pain General Health Vitality Social Functioning Role limitations – emotional Mental health	36 + Shorter versions	8	Trait	5, 6, 8, 9, 11, 12, 16
27	Montgomery-Asberg Depression rating scale	Montgomery and Asberg (1979)	Depression	10	1	Trait	3
28	Multidimensional affect and pain survey	(MAPS; Clark et al., 2002)	Somatosensory pain Emotional pain Well-being	30			1, 3, 5, 6, 8, 9, 16, 37
29	Multidimensional Fatigue Inventory (MFI-20)	Smets et al. (1995)	General fatigue Physical fatigue Reduced activity Reduced motivation Mental fatigue	20	5	Trait	8, 9, 17
30	Multidimensional Health Locus of Control (MHLC) Scales	(Wallston, Wallston, & DeVellis, 1978)	Internal control Powerful others external control Chance external control	18	3	Trait	44
31	Multidimensional Health Locus of Control	Wallston, Wallston, &	Internal belief Chance belief Powerful Others Belief	18	3	Trait	44

		DeVellis (1978)					
32	Multidimensional Mood State Questionnaire	(Steyer, Schwenkmezge r, Notz, and Eid, 1997)	Good/bad Calmness/nervousness Wakefulness/tiredness	30	3	State	2, 5, 8
33	Multi-level assessment model	(Lawton, 1982)	Physical health Cognition Activities of daily living Time use interactions Personal adjustment Perceived environment	101	7	Trait	1, 3, 5, 6, 9, 11, 12, 14, 23, 33, 36, 37, 41
34	Multiple Affect Adjective Check List	(MAACL; Zuckerman, Lubin, and Rinck, 1983)	Anxiety Depression Hostility Positive affect Sensation seeking	132	5	State	1, 3, 5, 6
35	Negative Life Events Inventory	(Wills et al., 1992)	Negative life events	20	1		31
36	Northwick Park Dependency Score	(Turner-Stokes et al., 1998)	Basic care needs Special nursing needs		2		11
37	Nottingham health profile	Hunt & McEwan (1980)	Pain Physical mobility Emotional reactions Energy Social isolation Sleep Daily living problems	Part 1: 38 Part 2: 7		Trait	8, 16, 11, 40, 43,
38	Orientation to Life Questionnaire	(Antonovsky, 1987)	Comprehensibility Manageability Meaning	29	3	Trait	12, 19, 24, 27, 46
39	Patient Health Questionnaire	(PHQ-9; Spitzer, 1999)	Depression	9	1	Trait	3
40	Pen State Worry Questionnaire	(PSWQ; Meyer et al., 1990)	Worry	16	1	State	42

41	Perceived Stress Questionnaire	(Levenstein, et al., 1993)	Stress Fatigue Reward	30	1	Trait	2, 8, 21
42	Perceived Stress Scale	(PSS; Cohen, 1983)	Stress Personal Control	10	1	Trait	2, 43
43	Personal Growth Initiative Scale (PGIS)	Robitschek (1998)	Personal growth	9	1	Trait	15

44	Profile of mood States 2	(POMS 2; McNair, Lorr, & Droppleman, 1989)	Anger Confusion Depression Fatigue Tension Vigour	65	6	State	3, 5, 8
45	Psychological Well-Being Scales	(Ryff, 2008)	Self-acceptance Positive relations Autonomy Environmental mastery Personal growth Purpose in life	54	6	Trait	12, 15, 27, 34, 44
46	Purpose in Life Test	(Crumbaugh and Maholick, 1964)	Purpose	20	1	Trait	7, 27, 29, 34, 37
47	Quality of Life After Brain Injury	(Steinbüchel et al., 2010)	Cognition Self Daily life and autonomy Social relationships Emotions Physical	37	6		3, 8, 9, 11, 12, 17, 42, 45
48	Quality of Life Inventory (QOLI)	Frisch (1992)	Quality of life Health Self-Esteem Goals and Values Money Work Play Learning Creativity Helping Love Friends Children	32	1	Trait	9, 12, 18, 22, 23, 26, 29, 35
49	Rosenberg's SelfEsteem Scale	(Rosenberg, 1965)	Self-esteem	10	1	Trait	18

50	Rotter Internal-External Locus of Control Scale	(Rotter, 1966)	Locus of Control	23	1	Trait/State	44
51	Self-Anchoring Striving Scale (The Ladder of Life)	Cantril (1965)	General Positive Affect General Negative Affect Satisfaction with Life	3	3	Trait and State	5, 6, 7
52	Self-Assessment Manikin	(SAM; Lang, 1980; Hodes, Cook, & Lang, 1985)	Pleasure/mood Arousal/active Dominance/control	3	3	State	4, 21, 8, 43
53	Self-Evaluation of Life Function Scale	(Linn and Linn, 1984)	Depression Physical functioning Self-esteem Social well-being Personal control Aging	54	6	Trait	3, 9, 12, 18
54	Sickness Impact Profile	Gilson et al., (1975)	Somatic autonomy Mobility control Psychological autonomy and Communication Emotional stability Mobility range Social behaviour	68 + Longer version	6	Trait	10, 11, 12, 40
55	Social Interaction Anxiety Scale	(SIAS; Hable, Hewitt, Norton, and Asmundson, 1997)	Social anxiety	20	1	Trait	1, 12
56	Social well-being scale	(Keyes, 1998)	Social acceptance Social actualisation Social contribution Social coherence Social integration	15	5	Trait	12, 20
57	Spiritual Index of Well-being	(Daaleman, and Frey, 2004)	Self-efficacy life-scheme	12	2	Trait	27, 30
58	St Andrew's-Swansea Neurobehavioral Outcome Scale	(Alderman, Wood, & Williams, 2011)	Interpersonal relationships Cognition Inhibition Aggression	49	5	Trait	12, 43, 45, 46

			Communication				
59	State self-esteem scale	(Heatherton & Polivy, 1991)	Performance self-esteem Social self-esteem Appearance self-esteem	20	3	State	18, 34
60	State-Trait Anxiety Scale	(Spielberger et al., 1970)	Anxiety	40	2	State/ Trait	1
61	Subjective Happiness Scale	(Lyubomirsky and Lepper, 1999)	Happiness	4	1	Trait	4
62	Symptom Checklist-90-Revised (SCL-90R)	Derogatis (1994)	Somatization Obsessive-Compulsive Interpersonal Sensitivity Depression Anxiety Hostility Phobic Anxiety Paranoid Ideation Psychoticism	90	9	Trait	1, 3
63	The Affect Balance Scale	(ABS; Bradburn, 1965, Revised 1969)	Positive affect Negative Affect	10	3	Trait	5, 6
64	The Bond-Lader visual analogue scales	(Bond & Lader, 1974)	Alert Calm Content	16	3	State	5, 8
65	The Center for Epidemiologic Studies Depression Scale	(Radloff, 1977, revised by Eaton et al., 2004)	Depression	20	1	Trait	3

66	The COPE Inventory	(Carver, Scheier, & Weintraub, 1989)	Positive reinterpretation and growth Mental disengagement Focus on and venting of emotions Use of instrumental social support Active coping Denial Religious coping Humour Behavioural disengagement Restraint Use of emotional social support Substance use Acceptance Suppression of competing activities Planning	53	11	Trait	19, 20, 33, 34, 38, 43
67	The Craig hospital inventory of environmental factors	(Harrison-Felix, 2001)	Accessibility Accommodation Resource availability Social support Equality	25	5		11, 20, 22, 36, 44
68	The Day Reconstruction Method	(DRM; Kahneman, Krueger, Schkade, Schwarz, and Stone, 2004)	Time use Emotional Affect Life satisfaction	-	1	State and Trait	5, 6, 7, 28, 37
69	The Extended satisfaction with life scale	(Alfonso et al., 1996)	General Satisfaction with life Social Sexual Self Physical Family School Work Relationship	50	9	Trait	7, 12, 13, 14, 18, 20, 22, 25, 26

70	The General Health Questionnaire	Goldberg, 1972	Somatic symptoms Anxiety and insomnia Depression Social dysfunction	37	4	Trait	1, 3, 9, 12
71	The general wellbeing Schedule	(Dupuy, 1977)	Anxiety Depression Positive well-being self-control vitality general health	18	6	Trait	1, 3, 5, 7, 8, 9, 37, 44
72	The Happiness Line measure	(HLM; Ivens 2007)	Happiness	1	1	Trait	4
73	The Happiness Measure	(HM; Fordyce, 1988)	Happiness	1	1	Trait	4
74	The Health Opinion Survey	(HOS; Semmence, 1969)	Neuroticism	27	1	Trait	8, 9

75	The health perceptions questionnaire	(Ware, 1976)	Current health Prior health Resistance/susceptibility Health outlook Health worry Sickness orientation Rejection of sick role Attitude	33	8	Trait	9, 42
76	The Hospital Anxiety and Depression Scale	(HADS; Zigmond and Snaith,	Anxiety Depression	14	2	Trait	1, 3
77	The Impact of Event Scale - Revised (IES-R)	(Weiss & Marmar, 1997)	Intrusion Avoidance Hyper arousal	22	3	Trait	31
78	The life events inventory	(Cochrane and Robinson, 1973)	Life events	55	1		31

79	The Life Satisfaction Index, A	(Bernice L. Neugarten and Robert J. Havighurst, 1961)	Satisfaction with life Motivation Reward Purpose and meaning Goals and achievements Self-esteem Optimistic General positive affect	20	5	Trait	7, 5, 17, 18, 19, 21, 27, 29
80	The Life Satisfaction Index, B	(Bernice L. Neugarten and Robert J. Havighurst, 1961)	Happiness Satisfaction with life	12	1	Trait	4, 7
81	The Lille Apathy Rating Scale (LARS)	(Sockeel, et al., 2006)	Everyday productivity Interests Taking the initiative Novelty Seeking Motivation Emotional responses Concern Social life Self-awareness	33	9	Trait	12, 17, 34, 35, 37, 38, 39, 40
82	The Mental Health Inventory	(Veit and Ware, 1983)	Anxiety Depression Loss of behavioural/emotional control General positive affect Emotional ties Life satisfaction	38	6	Trait	1, 2, 3, 4, 5, 7, 12, 19, 23, 37, 43
83	The Office for National Statistics' (ONS) subjective wellbeing questions	ONS, 2013	Life satisfaction Worthwhile Happiness Anxiety	4	1	Trait	1, 4, 7, 15
84	The Perceived Ability to Cope With Trauma (PACT) Scale	(Bonanno, Pat-Horenczyk and Noll, 2011)	Forward Focus Trauma Focus	20	2	Trait	33, 34

85	The Philadelphia Geriatric Centre Morale Scale	(M. Powell Lawton, 1972)	Agitation Attitude Toward Own Aging Lonely Dissatisfaction	22	3	Trait	6, 21, 33, 42, 43
86	The Positive and Negative Affect Scale	(PANAS; Watson, Clark and Tellegen, 1988)	Positive Affect Negative Affect	20	2	State	5, 6
87	The Quality of Well-Being Scale	(Bush and Kaplin, 1973)	Physical activities Social activities, Mobility Symptom/problem complexes	71	4		9, 11, 12
88	The Questionnaire for Eudaimonic Wellbeing	(Waterman et al., 2010)	Eudiamonic	21	1	Trait	15, 27, 37
89	The satisfaction with life scale	Diener et al., (1985)	Satisfaction with life	5	1	Trait	7
90	The scale of positive and negative experience	(Diener et al., 2010)	Positive Affect Negative Affect Affect Balance	12	3	Trait	5, 6
91	The semantic differential scale	(Mehrabian and Russell, 1974; Russell, 1980)	Pleasure/mood Arousal/active Dominance/control	18	3	State	4, 21, 8, 43
92	The Short DepressionHappiness Scale	(SDHS; Joseph, Linley, Harwood, Lewis, and McCollam, 2004)	Depression-Happiness	6	1	Trait	3, 4, 7, 27, 34
93	The temporal satisfaction with life scale	(Pavot, Diener and Suh, 1998)	Past Present Future	15	3	Trait	7, 32
94	The Twenty-Two Item Screening Score of Psychiatric	(Langner, 1962)	Neuroticism	22	1	Trait	1, 2, 3, 6

	Symptoms						
95	The UWIST Mood Adjective List	(UMACL; Matthews, Jones, and Chamberlain, 1990)	Hedonic tone Tense arousal/stress Energetic arousal	48	3	State	2, 5, 8
96	The WarwickEdinburgh Mental Well-being Scale	(Tennant et al., 2007)	Mental well-being	14	1	Trait	3, 5, 12, 15, 19
97	The WHO-5 WellBeing Index	(Bech, 1998)	Mental well-being	5	1	Trait	5, 8, 37
98	Trier Inventory for Chronic Stress	(TICS; Schulz et al., 2004)	Work Overload Social Overload Pressure to Perform Work Discontent Excessive Demands at Work Lack of Social Recognition Social Tensions Social Isolation Chronic Worrying	57	9	Trait	2, 4, 12, 26, 42
99	UCLA Loneliness Scale	(Russel, 1996)	Loneliness	20	1	Trait	20, 43
100	Visual Analogue Mood Scale	(VAMS ; Stern, Arruda, Hooper, Wolfner & Morey, 1997)	Sad Afraid Tired Angry Confused Happy Energetic	7	7	State	4, 5, 6, 8
101	Visual Analogue Self-esteem Scale	(VASES; Brumfitt and Sheeran, 1999)	Self-esteem	10	1	State	18
102	WHO Disability Assessment Schedule 2.0 (WHODAS 2.0)	(WHO, 2010)	Cognition Mobility Self-care Getting along Life activities Participation	12 + Longer version	1	Trait	11, 12, 23, 41

103	World Health Organisation Quality of life Assessment	(WHOQOL; WHO, 1994)	Physical domain Psychological domain Level of independence Social relationships Environment Spirituality/religion/ personal beliefs	100	6	Trait	5, 6, 8, 9, 11, 12, 14, 15, 16, 18, 19, 25, 27, 30, 34, 36
104	Zung Self Rating Anxiety Scale	(Zung, 1971)	Anxiety	20	1	Trait	1
105	Zung Self Rating Depression Scale	(Zung, 1965)	Depression	20	1	Trait	3, 8, 9, 19, 25, 37

Appendix C: Questions included in the 21-factor structure of Phase 1 questionnaire

Depression

 I have frequently felt depressed

 I have felt that my life is hardly worth living

 I have had suicidal thoughts

 I have frequently felt worthless

 I have sometimes felt like self-harming

 I have frequently felt I have nothing to look forward to

Goals and Motivation

 What I have done in my daily life has given me a sense of purpose

 I have been very motivated

 I have had the drive to get things done

 I frequently couldn't be bothered to do anything at all

 I have sometimes needed prompting to get started on an activity

 I have planned my life around my goals

 I have been happy with the goals I have set myself

 I have worked hard to achieve the goals I have set

 I have felt a sense of achievement

 I have been productive and able to get things done

 I have spent a lot of time just doing nothing

Discrimination

 Ethnicity

 Gender

 Age

 Looks and Appearance

 Physical disability and/or physical health issues

 Mental disability and/or mental health issues

 Sexual orientation

 Religion or belief

 Social class

Reward

 I have rewarded myself after achieving something

Pain and Physical health

 My physical health has been good

 Physical health problems have interfered with my ability to perform routine activities of daily living

 I have had no movement or mobility difficulties

 I have not suffered from physical pain

 My daily activities have been limited by physical pain

 I have been unable to enjoy doing my daily activities due to the pain I have experienced whilst doing them

Time

 I have frequently had 'no time' to do what I wanted

 I have had enough free time to relax and enjoy myself

45

 My responsibilities and commitments (e.g. as a student, worker, parent, carer, etc.) have meant that I have not had enough time for myself

 I have not had enough free time to devote to those who are important to me

Sleep

 I have fallen asleep quickly and easily when I went to bed intending to sleep

 I have suffered from insomnia

 I have frequently woken up during the night for no obvious reason

 If I have woken up during the night, I have fallen asleep quickly again

 I have been unable to sleep due to my mind racing as a result of stress/anxiety/tension etc.

 I have been satisfied with the quality of my sleep

Social

 I have been a sociable person

 My social life has been important to me

 My social life has not been good

 I have felt satisfied with the amount of social contact I have had

 I have felt satisfied with the quality of social contact I have had

Anxiety

 I have frequently felt anxious

 I have frequently felt anxious for no obvious reason

 I have frequently experienced physical symptoms which I believed were caused by anxiety (eg, cold or sweaty hands, shortness of breath, heart racing, etc)

 There have been unexpected events which have made me feel anxious

 I have experienced panic attacks

 I have frequently felt anxious in social situations

 I have frequently avoided social situations due to my anxiety

 I have frequently avoided doing things that I should have done or wanted to do due to my anxiety

 My anxiety has frequently interfered with my daily routine

Finance

 I have worried about whether I have enough money to cover all of my needs

 I have had enough money to cover all of my usual needs and responsibilities

 I have felt secure about my regular sources of income

 I have had enough money to pay for my wants (things beyond meeting basic 'needs' Eg, being able to participate in leisure activities, having money to buy items I want, etc)

Confidence

 I have frequently lacked confidence in my own abilities

 I have had lower self esteem

 I have thought that others have seen me in a negative light

 I have thought that others did not seem to like me

 I have worried about other people's attitude towards me

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Worry about Cognitive ability

 I have worried a lot about the quality/effectiveness of my memory

 I have worried about my ability to pay attention and stay focused

 I have worried about my ability to solve problems

 I have worried about my ability to make decisions

 I have worried about the speed of my thinking

Happiness

 There have been expected things which have put me in a good mood

 There have been unexpected things which have put me in a good mood

 There have been expected things that have made me feel happy

 There have been unexpected things that have made me feel happy

Diet

 I have taken an active role in looking after my health

 Eating healthily has been important to me

 I have eaten healthily

Emotional Reactivity

 I have recently experienced strong negative emotions

 My emotions have been very changeable

 I have found it hard to control my emotional responses

 I have felt so angry that it has interfered with my daily routine

 I have frequently experienced swings between positive and negative moods

 I have frequently struggled to cope with my own emotions

Stress

 I have frequently felt stressed

 There have been a lot of things causing me stress

Existential

 I have wondered what would happen to people who know me, after I die

 I have frequently spent time wondering what life is about

 I have frequently thought about death and mortality

Support

 I have not been able to fully trust one or more of those close to me

 I have been afraid of one or more of those close to me

Communication

 I have had no problems speaking

 I have had no problems understanding what other people are trying to tell me

Energy

 I have frequently felt physically fatigued and lacking in energy

 Physical fatigue and tiredness have interfered with my daily routine

 I have frequently felt mentally fatigued

 Mental health has interfered with my daily routine

 I have frequently felt tired and drowsy when I should have been wide awake

Appearance

 I have been worried about looking under-weight

 I have been worried about looking over-weight